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Engineering Library

May 14, 1925

Engineering News-Record

Beginning in this issue:

Engineering in the Small City

A New Series of Articles For and From the City Engineer

Notes from the field on the problems and practices of the municipal engineer in the cities below 100,000 population

OTHER ARTICLES: Reinforced Concrete Wood Pulp Paper Mill in Oregon —Bridge Engineering as It Was 50 Years Ago

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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An Unexplainable Disaster

ENGINEERS may well take pride in the behavior of that little band of their fellows who faced death bravely last week on the "Norman" before she went down in the swift current of the Mississippi. There was no sign of panic, no hysteria, no selfishness, but a calmness in the face of unexpected and unexplainable disaster that is a part of the engineering tradition. But the loss to the profession was grievous, the more so because like most accidents this one seems so unnecessary. Why a flat-bottom wide Mississippi River stern-wheeler should capsize on a calm day is beyond ready explanation, unless the boat was literally too heavy to float, which seems incredible. A full examination of the design of the boat and the placing of responsibility for the accident will not bring back those who were lost but it will serve perhaps to prevent repetition of this shocking disaster. That the government officials who owned the boat will make such an examination is assured.

Problems of the City Engineer

MUNICIPAL engineering, like all other kinds of engineering, is tending toward specialization. In our first class cities, especially, there frequently is no one engineer responsible for all the city's engineering work, but rather a group of specialists reporting to an administrative officer who as often as not is not an engineer at all. Water supply, sewage, refuse collection, street work, bridge building, all call for the services of men especially trained in those subjects and the city engineer, if there be such, becomes the director of them all and loses touch with the details of any one. In our smaller cities the city engineer to a much larger degree retains his direct control of all phases of city engineering. Even in the smaller cities, to be sure, there are apt to be several engineers independently caring for the various engineering necessities of the city, but the necessity for a wider range of knowledge of detail is much more pressing for the engineer of the city of 50,000 than for a city of a million. Indeed it will be found that in many of our cities the man who is doing the real city engineering work is not called "city engineer" at all but is more apt to be "superintendent of public works." But whatever be the name of the official the things he has to do are of interest to a large group. How these engineers work, how their offices are organized and how they solve their every day problems are things not too well known, even by the men who are engaged in such work. For that reason *Engineering News-Record* is going for some months to conduct an intensive campaign in this field. The first section appears in this issue. The value of the whole series will depend largely upon the co-operation of the engineers in the cities of their class. Their assistance will be sought, directly and by general appeal, with the promise that the return to all interested will be in proportion to the individual contributions.

Getting Engineering for Nothing

IN THE correspondence pages of this issue Professor McIntyre of the University of Pittsburgh calls attention to a particularly flagrant case of official ignorance of the rights and privileges of the engineer. A county board in Pennsylvania, about to embark on a paving program, has been sending around broadcast a questionnaire intended to answer the engineering problems that assail the board. That the board has only a faint conception of the fundamentals of paving practice is revealed by the nature of its queries, but provided it gets enough answers doubtless it will proceed to evolve some kind of majority opinion as to its best procedure and thereupon continue, with no further engineering advice, to negotiate with the commercial producers of paving for the required streets and roads. This is, of course, reprehensible on the part of the board, but it is conceivably due only to ignorance. Engineers should remember, however, that they are the ones responsible for such practices, for the board expects to get, and doubtless will get, a sufficient number of replies to make its effort worth while. The remedy lies with the engineering profession itself. The individual engineers who answer such requests are looking for business; in some short sighted way they grasp any straw offered and this looks like such a straw to them. Possibly, they hope, they may worm their way into the good graces of the board and the safe harbor of a job. The remedy lies with the professional groups in the district. The most salutary thing in such a case would be a public reprimand by an engineering society or section of the individuals who have co-operated with the board in this effort to get free engineering advice. Unfortunately in too many such cases there are not enough sinless to make stone throwing very effective.

Federal Aid Denied Day Labor

SIGNIFICANT action has been taken by the Bureau of Public Roads in denying federal aid to certain proposed day-labor road construction in Arizona. A statement of circumstances and policies brought out by the occasion is given by Thos. H. MacDonald, chief of the bureau, in another column. It deserves close attention both by highway officials and by road contractors. Naturally the statement which most interests contractors is that in which the bureau chief expresses his beliefs regarding force-account construction. It is worth repeating: "While I believe it is an established general principle that day-labor construction of highways is not economical, it is possible in specific cases that certain conditions, if existing, may justify a state in undertaking to construct a road with its own forces, but in no case is the adoption of the day-labor plan as a general policy justifiable from the standpoint of public policy or economy." Strengthened by the balance of the official announcement there is a prophetic significance to this statement. The disposition has been

growing in certain states, particularly where county control in road construction is strong or where state administrations have made it a political expedient, to increase force-account operation. In instances, contracting has been virtually eliminated in major highway construction. In nearly all these instances definite accounting of the operations is largely lacking. It has indeed been almost impossible to drag out complete and precise figures. It will be noted that both conditions were true in Arizona. In announcing candidly its attitude toward day-labor road work there and, inferentially, its future attitude elsewhere, the Bureau of Public Roads has done much to force the full accounting that day-labor operators have commonly denied. Once this condition exists contracting will drop its worries over day-labor competition.

Moving the Office to the Country

BOTH Secretary Mellon and Secretary Jardine showed extraordinary perspecuity in their indorsement of a proposal of a committee of the Department of Agriculture that a number of the needed new buildings of that department be located "on a suitable tract of land some distance from the city" of Washington. Many people are talking decentralization as a cure for urban congestion but how few are those in authority who have the courage to practice it. Our big cities grow bigger and the crowded sections of those cities are the very places that the employers pick out to locate new buildings which crowd the streets with more human beings. Downtown Washington is fast losing its distinction of being a commodious city. It never can, thanks to early sensible planning, be the shambles that some of our other cities are, but it can soon reach an uncomfortable congestion of buildings with an excess of going and coming employees to clutter the streets. Agricultural employees might quite reasonably, it would seem, be taken care of in the outskirts of the city with views and surroundings more or less agricultural. More power to the hand of the cabinet officers who would take such a decisive step.

Realignment of Standardization

A NOTEWORTHY event in the field of standardization has just been announced: the appointment of an industrial advisory council to the American Engineering Standards Committee. Half a dozen industrial executives of nationwide prominence are to assist the standards committee in developing its industrial work most fruitfully. The change represents another step toward swinging the broad current of standardization away from the so-called engineering field and toward the industrial field. It supplements a preliminary step made two years ago, when the standards committee established a class of industrial membership and pledged itself to devote a large part of its activities to the needs of industrial production.

Careful review of standardization activities during recent years indicate that this realignment of program is in the direction of progress. There are great potentialities for effective work in the industrial field, and the standards committee under the new system likely to evolve as a result of the advisory council appointment should prove excellently adapted to develop these potentialities. If the change now inaugurated attains full growth it will transform an organization of limited effectiveness to one having a beneficial influence on the entire production mechanism of the nation.

Hitherto the American Engineering Standards Committee has been devoted largely to primary standardization work—fixing the shapes and sizes of basic interchange elements of construction and formulating quality specifications. However, work of this kind went on before the organization of the committee and has continued in the same way since; in fact, it has not been noticeably affected by the existence of the standards committee. Prior to six years ago, various technical societies and groups of societies were carrying on such work, and they have continued it unchanged, with neither acceleration nor check. While many of the resulting standards have been hall-marked by the committee, no striking effect was produced by such indorsement and certification. As powerful influence for soundness in standardization, the committee deserves due credit, but it can hardly claim any large accomplishment in stimulating or guiding the pre-existing activity.

These conditions gradually coming to be perceived, even though unconsciously, doubt has recently arisen in many minds whether the standards committee could hope to justify its existence on the score of its functions in the field of technical standardization. At the same time, however, it became clear that there is a large and important field of activity in industrial standardization, and that this field is seriously in need of the standards committee as a central co-ordinating agency.

Industrial standardization — the standardization of manufactured products—has no such efficient agency as technical standardization. Competing producers do not join together readily, and, when they do, are more likely to occupy themselves with aggressive than with constructive endeavors. Nevertheless, many industrial associations have come into being, and a great deal of work has been accomplished by them in the direction of improving the efficiency of production by eliminating injurious or unnecessary variations. The government has assisted materially in this work, notably through the Department of Commerce and the Department of Agriculture. However, the field is so vast that what has as yet been done is small indeed in comparison with the total.

Abroad, in the meantime, industrial standardization has been proceeding in small systematized, efficient manner under the direction of a central co-ordinating body. In nearly every foreign country, standardization has concerned itself almost wholly with the industrial field. Technical standardization has played a subordinate part, and in any event does not appear to have been of much value or effect if one may judge by the many revisions and changes which it has entrained. The main effort has been directed toward economy in production, under pressure of the almost world-wide economic stress.

It will be obvious that industrial as well as technical standardization affects two or more parties, and that the co-operation of all of these must be obtained if the standardization is to be successful. The maker alone cannot ordinarily fix a standard which the user is not willing to accept. For this reason collaboration of the several parties, as put into practice first by the American Society for Testing Materials and later incorporated in the working rules of the American Engineering Standards Committee, is a necessary element of the working method. It is almost equally important

that the co-operation be voluntary and that it should have the advantage of all the enthusiasm which results from having the standardization actually originate with the affected parties themselves. This second requirement also is embodied in the standards committee's practice. Thus, the committee is almost ideally constituted to be the central agency of industrial standardization.

Taking the whole situation into account, the new departure is of decided promise. Its scope and possibilities are difficult to foresee, but the working field is extremely large. Developing objectives and methods for a program of work differing essentially from that followed heretofore will take time and careful thought. During this formative period broadminded, farseeing guidance will be of decisive value. The industrial advisory council, no doubt, will supply such guidance.

A Sore Spot in Contract Bonding

AS A forerunner of the coming mayorality campaign in New York City, there has just been brought out into the open a thing that has been common talk among construction men in the metropolis for many months, that is the alleged connection between the city government and a firm of surety bond brokers, whose head has several brothers and a father in close political alliance with the mayor. Charges are being freely made that contractors in city work find it to their advantage to have this firm write their surety bonds to such an extent that it has what approaches a monopoly in this business. So far the examination has not gone far enough to warrant any charges of collusion or of criminality but the facts known to many are sufficient to indicate that in New York there does exist a situation in relation to contract surety bonding which in the whole business of bonding approaches a scandal, for the New York case, whatever be the outcome, is only typical of conditions elsewhere.

As contract bonding is organized the direct writing of the bond is cared for by an agent or broker, for the most part operating on a commission basis. This commission, amounting generally to about 30 per cent of the premium, goes entirely to the broker who furnishes therefor certain services of informational character and who takes care of the process of writing the bond. The bond itself, however, is written by surety companies who take whatever risk there is. None of the risk of a forfeited contract falls on the broker. It can be readily seen that success or failure in the business of being a surety bond broker, as in all brokerage businesses, depends upon the quality of the service the broker can render. No matter what broker gets the bond, it is written by a large and responsible company. Friendship, willingness to serve, statistical information all are stock in trade of the successful broker.

Naturally, since honesty is not a universal virtue, this system has been abused. In its worst form this dishonesty takes advantage of the obvious opportunity to make a collusive arrangement with the governmental contracting authorities, and there is a split-up between those authorities and the broker of the fees, with compensation to the contractor in reduction of the rigorous enforcement of the contract. A broker so operating—in criminal fashion, of course—has obvious advantages to offer the contractor whose conscience and disregard of the law permits him to accept them.

Such absolutely dishonest cases are fortunately rare, but the connotation of such criminality extends over into a practice which is quite common. That is for the governmental contracting officer, either of himself or through close friends or relatives, setting up in the minds of the contractors the impression, sometimes warranted by subsequent procedure and sometimes not, that a contractor taking out his bond through the favored agent will thereby get in the good graces of the government body. This impression may be only psychological. The contractor may have no evidence whatever that he will be treated any differently if he calls in the favored agent, but he stills whatever conscientious qualms he may have by saying to himself in effect, "No matter what agent I employ, I'll get a bond from the same or equally good companies. I'm not in this business for my health. There's nothing criminal in giving this to Jim and nobody's promising me anything. Still, I might as well be on the safe side. I'll take it from him."

There is no doubt that this practice is common. Proof of it in specific cases is difficult, because so far it has rarely been made the subject of judicial or legislative investigation where the perjury laws hold. Further than that when the pressure exerted is purely psychological, as noted in the preceding paragraph, it is doubtful whether it is illegal. But there is no question that it is unethical and that it is degrading of both the business of contracting and of surety bonding. It not only reduces fair competition among bonding brokers, but it so easily runs over into the criminal territory wherein real advantages are given the contractor who uses the favored agent, that the boundary line becomes quite nebulous.

Who is going to cure the evil? The contractors? They could if they could be gotten in specific cases to forget their personal chance for profit in the good to the community, and could insure that a proximate unanimity of action would be taken in refusing to do business with collusive brokers. But this is a rather Utopian expectation in such a competitive field. The bonding companies? Their opportunity is greater, because they always know when their agents have sinister connections, and could discipline them or remove them. But here, too, is a highly competitive field, one indeed in which the competition is so fierce that those in it profess to be unable to make any reforms because of their inability to get together. The public? Only where criminality is suggested or proved, in which case the ordinary process of law affects the specific violation, and by the publicity so gained may serve to emphasize the evil.

Indeed in publicity there seems to be the best way out. Every such investigation as the one now being conducted in New York will spotlight this sore spot in surety bonding. It will make public officials more meticulous in their control of the activities of friends and retainers who capitalize their relations with the powers that be. Only a month ago the incoming treasurer of one of our largest states announced at a contractor's dinner that there would be no one who could seek surety bond business on a claim or even an implication of influence with the awarding officer of that state. Similar public recognition will hearten contractors who want no illegal favors to resist the importunities of sinister solicitors and may persuade bonding companies that public house cleaning is worth while.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

Beginning in this issue this section will appear each week during the coming summer. It will contain, in addition to a brief sketch of the city engineering problems in one of a selected country-wide list of small cities, several short articles on the practical solutions of engineering problems peculiar to these smaller municipalities.

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

Jamestown, N.Y.

A CITY IN CHAUTAUQUA COUNTY, N. Y., 70 miles by rail south by west of Buffalo, on the outlet of Chautauqua Lake. Lies mostly on two hills on either side of Chadakoin Creek, in a narrow valley whose hills rise to some 100 ft. on either side. The center of a productive farming district and has large manufacturing interests, including several worsted mills, furniture and lounge factories, saw mills, a cotton mill, and manufactures of metallic goods, voting machines, pianos, towels, bank vaults, and photographic paper. Settled in 1810, laid out in 1815, incorporated as a village in 1827, and chartered as a city in 1886. Pop. (est. 1924), 40,000.

IN JAMESTOWN the director of public works and the city engineer are the same man. He is appointed by the mayor and confirmed by the Council. Until 1923 there was a decided lack of co-ordination of city engineering services, so the city charter was revised under a state law passed by the 1923 Legislature. Under the new charter, the director of public works has control of all city engineering work and, in addition, is a member of the Board of Public Utilities, there being five members, one of whom may be a councilman but two of whom must be the mayor and the director of public works. The administration of water and light utilities is under the control of this board.

Partly because of the ready availability of paving materials and partly because the custom has grown slowly and proved successful, the city does a great deal of its work by force account. This has affected considerably the organization of the engineering office. The present director of public works is Leonard A. Bergman. His field and office staff consists principally of two office engineers (one a chief draftsman) and at least one field party, that field force being enlarged during the construction season. His actual construction staff consists of a general foreman for paving and sidewalk work, two sidewalk gangs of six men each, and a third gang that devotes all of its time to driveways. Driveways are built by the city and charged against the property mainly to secure uniformity of driveways. Separate gangs are organized as needed for sewer extensions.

As the director of public works, the city engineer is a direct buyer of considerable construction equipment. At the present time there is in the material storehouses about $70,000 worth of such equipment. This includes all machinery and plant necessary for the extensive street, sidewalk and gutter work and what sewer construction is undertaken—these being the chief items of construction.

Due to the fact that the city does all of its own construction work, the city engineer becomes a rather large employer of common and skilled labor. Mr. Bergman himself interviews early in the construction season or late in the winter most of these who apply for jobs, so that preliminaries may be disposed of by the time any particular job starts. The character of labor is such that there is exhibited, if not a certain local pride, at least a thorough knowledge of the town. Aside from his technical and general executive functions the city engineer is appealed to by private individuals in numerous instances. The spectacle, for instance, of a mother appearing at the city engineer's office with a child in her arms, to discover the possibility of expediting the construction of a driveway so that her truck-driver husband would not have to park his truck in front of the house, is rather an unusual and interesting one. However, for the city of Jamestown, it is not at all unusual.

Paving Details—With both brick-clay and gravel locally available in almost unlimited quantity, the city turned a number of years ago to the use of brick in its paving work, which, as has been said, is all done by the city itself. In the town there are approximately 820,000 sq.yd. of paving, at least 85 per cent of which is brick. The rest is mainly asphalt block. Streets have an average width of 75 ft. between property lines and a pavement area 30 ft. wide. Curb and gutter sections are monolithic concrete, gutters being 15 in. wide in paved streets and 24 in. on earth streets, with a curb rising from 4½ to 6 in. and with a top width about 4 in. No refinements in surveying are called for because of the steep slopes most of the streets have, giving easy adjustment to the controlling grades.

Original paving was brick laid on a sand cushion upon a 5-in. concrete base. Pitch filler was used in the pavement laid 25 years ago. Standard new constructions follows the standards of the National Paving Brick Manufacturers Association for wire-cut lug brick (used exclusively). Brick is all made locally, and the standard has always been high.

New work is done as follows: Subgrade is brought to the proper section and a 5-in. concrete base is laid. Bank-run gravel is used as aggregate, and a 1:6 mix made which corresponds to about a 1:2:4 mix of graded aggregate. The city maintains its own gravel pit from which it has been getting gravel for the past ten or twelve years. There is about a two years' supply still left in it. Upon the concrete base a 1-in. sand-cement cushion is placed, and then the brick is laid with an asphalt filler. This sort of construction is followed on grades except the steepest, when hillside brick is used. Hillside is used on one 14 per cent street and another 12½ per cent. During 1924 the city laid something like 55,000 sq.yd. of this paving at an average cost of 42c. a square foot.

Mr. Bergman says that by doing his own work and continuing the same organization he maintains the

integrity of the prevailing type of paving. It would be difficult, without great expense, to let by contract work in as small jobs as he is able to handle himself. No matter how small the job there would be a certain necessity on the contractor's part for the installation of plant and arrangement of work. Brick roads and methods of building have been found satisfactory and have been continued. Mr. Bergman likes the idea of not having to bother about inspectors and their reports and responsibilities.

Sanitary Services—Sewage, in a combined system, is disposed of by carrying it about three and one-half miles down the Chadakoin valley to the Cassadaga. The outfall is a 30-in. brick sewer of circular section and the grade is such that all sewage and storm water is disposed of easily. Grades in all parts of the city are such that an 8-in. pipe is enough except for trunk sewers. All of the flow is in one general direction with the exception of about 1,000 ft., which has to be pumped to reach a trunk sewer.

The city engages consultants for its most important engineering studies or installations. For instance, it has retained H. Burdette Cleveland as sanitary engineering consultant. Mr. Cleveland has made a study of the sewage-disposal problem and has recommended Imhoff tanks located at the present outfall for the ultimate installation which probably will be made in a few years. There was a typhoid scare in the town during the summer of 1924 and the farmers in the vicinity of the outfall (the sewer discharges into the Cassadaga) have for some time been clamoring for other means of disposal.

Water supply comes from artesian and other wells about two miles above the sewer outfall in the Cassadaga basin. The water is pure and needs no kind of treatment, being pumped from the wells to storage.

The city contracts to have its garbage disposed of. There is a city ordinance requiring householders to wrap garbage and keep it in tight containers. Daily collection obtains in only the business center of the city, there being weekly collection elsewhere. The city pays $24,000 yearly to have the garbage collected, and the contractor makes not a cent on collection. He maintains two piggeries: one at a winter farm just outside the city limits, and the other at a summer farm that is much farther and isolated. These two farms aggregate 250 acres. The contractor is a local farmer and very reliable, and is reported to be making money out of his piggeries. Besides the actual cash the city pays it furnishes the collection carts, the farmer furnishing the horses and keeping all the city's equipment in repair.

Other Services—One unique thing which Jamestown does is own and operate a tree nursery. Not only does it raise trees for its parks but sells many of them to private individuals, and at about half the cost of competing prices. The nursery has under constant cultivation from five to six acres of trees raised from seedlings, including chiefly elm, maple and oak of various species, and also linden.

Financing—Until the charter was revised there was no money available for pavement reconstruction. There is now made available through charter provision about $50,000 for that purpose alone. No budgetary provisions are made for anything except office expense and general operating expenses. New paving work is financed through issuance of paving certificates, secured through money collected from property owners who pay for the new work. If any great amount of sewer work is contemplated bonds are issued by the council to cover the cost, as the city operates well within its constitutional debt limits. The board of public utilities has a budget to pay for anything but extraordinary installations.

Though the city maintains a zoning board (board of appeals) it functions merely in an advisory capacity and has no money with which to operate. The people appear to be behind the spirit of zoning rather than back of any board, and for that reason there is little call for any recommendations from the board of appeals for the council to act upon. The industrial district is restricted, largely through availability of water from the Chadakoin and railway sidings, to the narrow valley. There is considerable discharge of industrial wastes and the woolen mills contaminate and poison the Chadakoin with dyes. But no one cares whether the fish in the Chadakoin live or not as there is such better fishing in the lake.

Street cleaning is greatly facilitated by the grade of the streets. A light rain washes them clean. The public works department maintains, however, two power flushers, one of 1,200-gal. and the other of 1,500-gal. capacity.

The city erected some time ago a public market that has proved more or less a gold mine. Stalls are rented to anyone wishing to pay the license.

During the last three or four years the city has carried on rather an extensive bridge construction program. Included in this program is the construction, now under way, of a 1,000-ft. structure to span the Erie tracks. A special bridge commission was formed for this purpose, the city engineer being a member of that commission. The design was made by Harrington, Howard & Ash.

The Real Value of Keeping Assessment Maps Accurate and Up-to-Date

By B. K. Finch
City Engineer, Wilkes-Barre, Pa.

Of ALL the problems of municipal government the one of finance is the most essential. The primary source of revenue is from the assessment of the subdivisions of land located within the city's boundaries. Much may be said about the methods and manner of making assessments, means at hand for the determination of property values and ways of avoiding duplication and omissions in assessment work.

In the year 1913 a bill was presented and passed by both houses of the Pennsylvania Legislature, entitled "An Act, for the Incorporation, Regulation and Government for Cities of the Third Class," etc. On June 27, that bill was approved. An excerpt follows:

"For the purpose of procuring accurate information in reference to the ownership of all real estate, the council of each of said cities in the third class shall provide by ordinance for a registry thereof.

"The city engineer of any of said cities in which such registry shall be established as aforesaid, under the direction of council, shall cause to be made all such necessary books, maps, and plans as will show the situation and dimensions of each property therein, which books, maps or plans shall be so prepared as to show the city, number, and name of the owner or

owners thereof with provisions for names of future owners."

Prior to this time, the only tangible records of properties in our municipality were recorded in the books of the assessors, which were revised and adjusted at every triennial assessment and modified and corrected during the intervening years. Values were determined by inspection and visual appraisal. With the expiration of their terms of office, and the appointment of new successors, a revision of values would take place due to different conceptions and different appraisals by the new appointees, which made, to say the least, a very unsatisfactory adjustment in most cases.

Upon the passage of the act mentioned herein, after considerable thought and investigation as to how best to preserve, record, and file the registrations, that the best interests of the public might be served, two men were detailed by the city engineer to draft sectional maps of the city under his direction and approval. These maps are 24x24 in. on a scale of 50 ft. to the inch. Upon each section has been drafted a corrected survey of the streets and also an allotment of all sub-divisions in the particular locality approximating in all about 17,000 pieces of property in our city. These maps have been bound in book form, indexed and are always open for public inspection and information. Upon the receipt of a description for the transfer of a property, on the forms provided by this office, that description is immediately transferred or checked on these maps and then corrected on the blotters and copies of the assessor's books.

The form is then returned to the city engineer's office, where a card indexing system is maintained, and the change of ownership noted on this system. The form sheet is then filed in steel filing cases, designed for the purpose, and is at the disposal of any citizen who has occasion to use the same.

These maps are so elaborate in detail and present at a glance such a comprehensive scope of the values of the property in the areas which they circumscribe, that it has become the custom of professional appraisors employed by realtors of the city first to visit our office and thoroughly investigate values, areas, and distances, before arriving at their final conclusions. Nor is it only the professional appraisor who has profited by these maps. A large percentage of the attorneys of the municipality visit the offices and inspect our maps prior to drawing descriptions for any subdivisions of land, accepting with a finalty such information as measurements, adjoining ownership and abutting streets. They are also used to great advantage by private engineers in the locality, who in the adjustments of lines accept measurements as shown thereon. Lastly, they have become invaluable for the determination of values for the location of property hitherto unassessed and for the avoidance of duplication of assessments.

These maps have been the means of increasing assessments in the city during the first year of their inception more than $2,000,000, simply by presenting a comparison in a comprehensive form, which it was impossible to show by any record previously on hand. To date, there have been 12,727 registrations of real estate in our city, which carries about a total of 15,000 parcels in all.

Engineering Work

Part-Circle Culverts Extensively Used in California Cities

TO ELIMINATE surface drains or swales and to provide smooth, uninterrupted pavements at street intersections, many small cities along the Pacific Coast, particularly in California, unable to install expensive storm-water sewer systems, have standardized on part-circle culverts. Some of these culverts have been down for 15 years, though only recently has the practice become widespread. At the present time about 130 municipalities employ this type of construction.

The types of part-circle culvert installations vary, though in the sketch herewith are shown sections of a typical culvert of a design which is being rapidly adopted in southern California cities. The outstanding advantage of this newer design is the removal of culvert inlets and outlets from the gutters and the utilization of the entire space between curbs at intersections for vehicular traffic. This particular design is well adapted to new subdivisions where sidewalks are not yet in place.

B. G. Marshall, one of the engineers of the California Corrugated Culvert Co., has made an extensive study of the installation of part-circle culverts. The results of his investigations embody the following recommendations as to design. Arches range from an 8-in. base

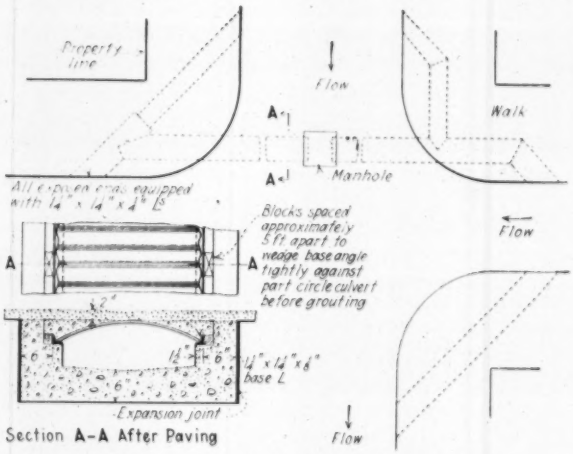


FIG. 1—RECOMMENDED PRACTICE FOR PART-CIRCLE DRAINS

and 2-in. rise to 84-in. base and 42-in. rise, and pipe can be secured in gages from No. 16 to No. 8. With respect to any particular installation, the question arises as to the gage of metal necessary for insuring ample strength. Practice varies but it has been recommended that for an 8-in. radius of pipe the gage should be not less than 14; for 14-in. radius, not less than 12 gage; for 24-in. radius, not less than 10 gage; and for 49-in. radius, not less than 8 gage. The radius referred to is that of the circle of which the arch forms a part.

The spring-line arch should rest on a shelf above the bottom of the culvert to prevent clogging at the corners. The thrust due to the arch should react against a base angle iron 1¼x1¼x⅛ in. The shelf should be 1½ in. after the culvert is laid. When building the forms at least

Of the Small City

3 in. should be allowed for the shelf. This, it is pointed out, will facilitate the placing of the culvert. The angle iron should be blocked out at intervals of approximately 5 ft. so as to fit snugly against the corrugated arch before the whole structure is grouted in. The concrete shoulders should be not less than 6 in. and the thickness of the bottom should not be less than 6 in. All exposed ends should be protected by angle iron riveted to the sheet. The depth of covering over the arch should be not less than 2 in. for black-top pavement.

FIG. 2—STREET INTERSECTION WITH OPEN SWALE AND PART-CIRCLE DRAIN
The intersection of two Bakersfield, Calif., street with the swale shown above. Drain entrance in this case is in the gutter and not as in Fig. 1, which best practice recommends.

Concrete junction boxes are recommended at culvert intersections. Where the pavement is of concrete, asphalt expansion joints should be placed between the culvert sections and the street so as to care for expansion and contraction of the pavement.

With this part-circle culvert installation, drains can be so arranged as to care for surface waters for distances of several blocks so that the number of comparatively extensive storm drain structures necessary for final disposal is not more than one-fourth or one-third of what otherwise would be needed. Also, swales at street intersections, hazardous to motor traffic and particularly fast-moving, heavy vehicles, and unsightly and more or less insanitary, are eliminated.

New Gravity Water Supply for Staunton, Va.

By Lee H. Williamson
Consulting Engineer, Charlottsville, Va.

STAUNTON, VA., with a population of 10,500 now derives its water from numerous limestone springs lying in the outskirts of the city. A steam-driven pump lifts the water to a 2.5-m.g. distribution reservoir. An electrically-driven centrifugal pump serves as a standby.

Flow from the springs has decreased until inadequate for the growing demand, pollution has become a menace, and limestone water causes abnormal repairs to both industrial and domestic plumbing. A thorough investigation for a new source of supply was made in 1923. The north fork of the Shenandoah River, or North River, from which water can be obtained by gravity, was proven to be the most logical, economical and popular source for a future supply of soft water. Construction work thereon was begun in October, 1924.

At the intake, storage will be developed by a 150-m.g.d. impounding dam of concrete approximately 350 ft. long, with an overflow spillway section 40 ft. high, about 200 ft. long. The drainage area of 25 sq.mi. is situated in the National Forest Reserve and therefore free from pollution.

Considerations of available head and economy necessitated bringing the supply through the ridge between North River and Staunton, thus requiring a 6x6-ft. tunnel, 5,700 ft. long, through sandstone. If the bore proves sufficiently tight, the tunnel itself will be put under pressure; if not, concrete pipe will be used for this section; in either case ample capacity for future expansion of the system will be provided.

The supply main is of 16-in. cast-iron pipe with leadite joints, 72,000 ft. long, discharging through an aerator into a 3.5-m.g. concrete-lined reservoir with earth embankments. This reservoir is connected with the distribution system through the existing distribution reservoir, thus giving 6 m.g. of storage capacity at the city.

Flow in the pipe line is controlled only at the intake, since topographic features divide the line into sections which can be drained by blowoffs. Direct outlet through a standpipe type aerator prevents the possibility of static head. The pipe line is, therefore, designed for pressure from the hydraulic gradient.

Work on all features except the distribution reservoir is well under way. Contracts for this structure will shortly be let and it is hoped to have the entire system in operation by June, 1926. The approximate total cost is $750,000, divided as follows: dam, $150,000; tunnel, $190,000; pipe lines, $360,000; reservoir, $50,000; total $750,000.

Sufficient head has been allowed for filtration if required in the future. The capacity of the system is 2.5 m.g.d., which can be materially increased by providing additional storage, above the present intake, with the necessary supply main.

Willard F. Day is city manager. The engineering work is under the direction of Fuller & McClintock, New York City, consulting engineers. Charles H. Chandler is resident engineer, and the writer is designing and supervising engineer. Contractors for the tunnel and dam are P. G. Ligon of Baltimore, Md.; and on the pipe lines the Pace Construction Co., Roanoke, Va.

Bridge Building on an Indiana State Highway

Contracts for a Series of Bridges Let to One Firm for All Concrete Substructures and Spans, and to Another Firm for Steel Spans—Design and Construction Features

ONE CONTRACTOR built fifteen consecutive concrete bridges and substructures for steel bridges in a distance of thirty miles, and another built all steel spans, in the recent reconstruction of a 30-mile stretch of the Indianapolis-Louisville federal-aid highway under the direction of the Indiana State Highway Commission. The concrete contractor took advantage of this arrangement to reduce costs by using a single concreting plant and designing the forms for re-use in a number of duplicate spans. Of the fifteen structures, seven have steel spans only and three have both steel and concrete spans, while the other five are entirely of concrete.

The work for this series of structures was let under a provision of the Indiana law which permits grouping a number of adjacent structures in one combination contract. This method has the advantage of giving the contractor a sufficient amount of work to enable him to purchase materials in quantity and also to warrant the installation of the most suitable and adequate plant. In the present case, the contractor for the first section of the concrete work was logically the low bidder on the next continuing contract, since he had his plant on the ground and was in position to extend his orders for material. By coincidence, one bridge company secured the contracts for all steel superstructures on both sections. The heavy grading for the road was awarded to two other contractors.

Reconstruction of this stretch of highway was undertaken in order to put it above flood level and thus give a permanent means of communication for the surrounding district, since the flooding of the old road has left the district practically isolated for a time each year. Three broad and shallow valleys or flat bottom lands are traversed in the north half of the thirty miles, necessitating a fill of about 8 ft. for the new road, which is 1½ ft. above the highest known flood level. A typical bridge is that over Vernon Fork, Fig. 1, with a steel channel span and low concrete viaduct approaches over the flat land on each side, but in some structures the viaduct portion is much longer. A few heavy cuts supply part of the fill, a gasoline shovel loading 1-yd. cars on portable steel tracks of 24-in. gage, trains of three or four cars being handled by gasoline locomotives. For the remainder of the fill, dragline excavators take material from side borrow ditches and cast it directly in place, although there is some objection to this kind of work on the part of the farmers who claim that the pits encourage the growth of willows, hold water and interfere with drainage of the adjacent land.

Determination of Waterways—In order to give the required water capacity for flood waters with the low headroom available it was necessary at several of the bridges to provide long concrete approaches. Thus, at each of the two crossings of the Muscatatuck River there is a 124-ft. steel truss span with twelve concrete spans of 38 ft. in the clear. The difference in waterway area of the new and old bridges is illustrated by the fact that one of these long structures over the river replaces a single 95-ft. truss span, while at Vernon Fork the old 66-ft. truss span is replaced by a 124-ft. truss and five 38-ft. concrete spans. In some cases the approach viaducts are only a few feet above the elevation of the flat ground bordering on the river channel.

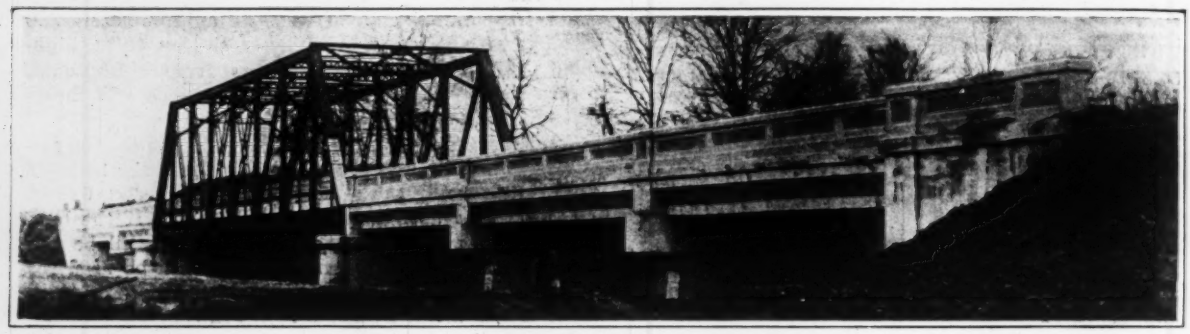


FIG. 1—HIGHWAY BRIDGE OVER VERNON FORK, INDIANA
Steel span, 124 ft. Concrete viaduct approaches over low ground subject to flooding.

In determining the areas for the new waterway openings, comparison with the old bridges was useless, since in flood times the highway was overflowed to a depth of 6 ft. or more for approximately six miles within the vicinity of the old bridges. But all the new structures are on the upstream side of bridges on the Pennsylvania R.R. and the Indianapolis-Louisville interurban line of the Interstate Public Service Co., which are on contiguous rights-of-way and in the main are parallel with and only a short distance from the new road. After a study of the drainage areas and of the records of these companies, together with an examination of flood levels on the several structures, the amount of waterway to be provided at each opening was determined largely by comparison with those of the two railroads.

Steel Bridges—Two types of steel spans are included on these contracts, both being standard designs of the State Highway Department: First, through-truss riveted spans 124 ft. long, with trusses 21 ft. deep and 21 ft. 3 in. c. to c. and I-beam floor members; second, pony-truss riveted spans 48, 55 and 72 ft. long,

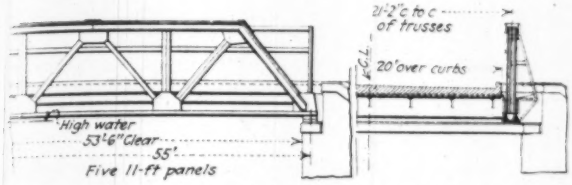


FIG. 2—TYPICAL PONY TRUSS SPAN

with I-beam floor members; in the 55-ft. spans the truss depth is 6½ ft. To compensate for the absence of top lateral bracing in this second type, each truss is reinforced by a trussed outrigger on the post at each intermediate panel point (Fig. 2). Another bridge on this road, but let under a separate contract, will have two 150-ft. through-truss spans over Stucker Creek and two 84-ft. through girder spans over the adjacent tracks of the interurban line and the Pennsylvania R.R.

An 8-in. reinforced-concrete slab is laid on the floor framing of all steel spans, giving a roadway 19½ ft. wide between the curbs, which form the only provision to protect truss members from being struck by vehicles traveling too close to the side of the road.

Concrete Structures—No less than 35 of the concrete trestle spans are for clear openings of 38 ft. In addition there are four of 22 ft., two of 18½ ft. and one of 28 ft. All are of the slab-and-girder type. In the typical 38-ft. span, Fig. 3, there are six girders with a slab 9½ to 7½ in. thick, the total depth at center of roadway being 39 in. Each outer girder is extended to form a curb and the base of the parapet wall, its lower part being inclined or beveled, as shown, to reduce the amount of material and improve the appearance. In pouring the piers, the concrete is carried up to form the parapet, while the parapets along the spans are poured separately and framed into the outer girder. In this way, the parapet of each span has an expansion joint at each end and there is no joint in the parapet over the middle of the piers. The roadway width between curbs is 19½ ft.

All piers for the concrete girder spans are two-post bents with caps, the two posts being seated on a single concrete footing or sill on timber foundation piles (see Fig. 3). Some abutments have flaring wing walls of the semi-gravity cantilever counterfort type; others have straight parallel walls of the thin reinforced type, but with the walls connected by reinforced-concrete ties which are embedded in the fill. This latter type of U-abutment is used on all the longer structures, for reasons of economy and uniform appearance.

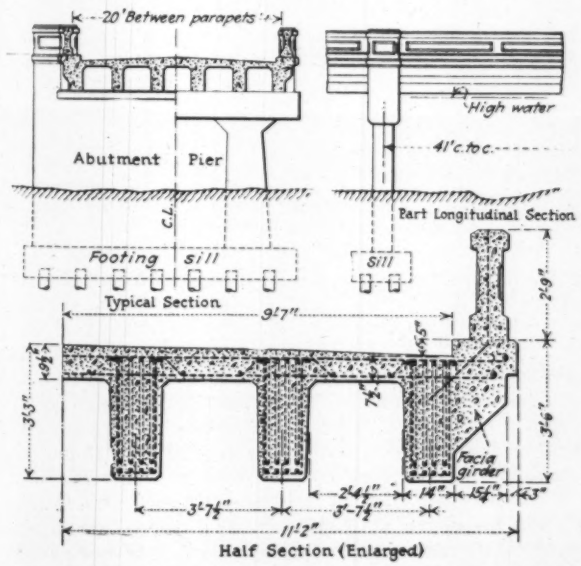


FIG. 3—TYPICAL 38-FT. REINFORCED-CONCRETE SPAN

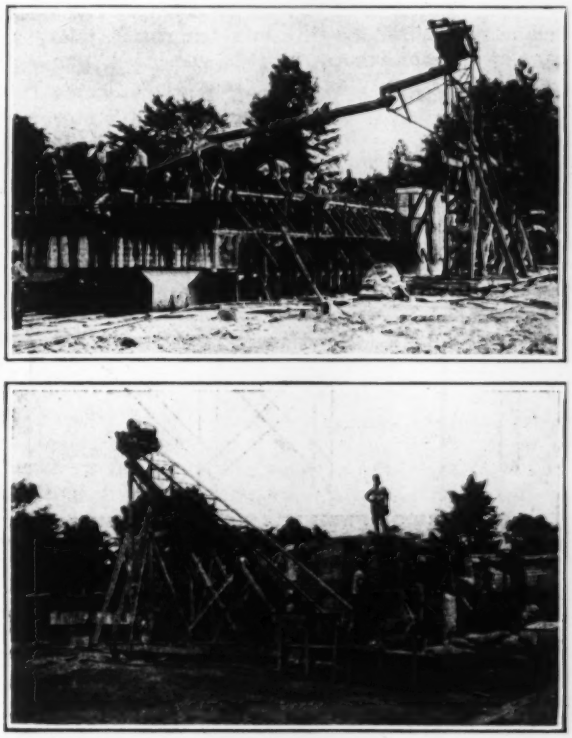


FIG. 4—CONCRETING PLANTS FOR BRIDGES

Expansion joints in the longer viaduct approaches are provided at intervals of about 120 ft., these viaducts being built in three-span monolithic units. The adjacent ends of the units are seated on a single layer of tarred roofing paper which separates the concrete of the spans from that of the pier. The joint, normally ½ in. wide, is filled with felt and pitch, the felt being trimmed off level with the surface of the roadway after the concrete has taken its set. Each bridge is protected against creeping of the reinforced-concrete highway slab on the approach fills by means of a 4-in. asphalt-filled expansion joint about 15 ft. from each abutment. This precaution has been taken because on some previous work the pressure due to such creeping has caused the paving slab to rise above the bridge floor slab; it has also caused spalling of parapets and serious cracking of wing walls and abutments, particularly where the bridge was on a skew.

Construction Features and Plant—Foundation difficulties were encountered in some cases owing to quicksand pockets not clearly realized from the preliminary wash borings. The quicksand boiled up to such an extent that it was necessary to construct cofferdams of steel sheetpiling with 12x12-in. bracing for foundations as much as 400 to 500 ft. from the stream and only 14 to 18 ft. below the surrounding ground level. Beneath

the quicksand was firm clay and shale into which timber foundation piles were driven. On completion of the concrete work the steel sheeting was withdrawn, the footings and foundation piling being at such depth that no permanent sheeting as protection against scour was necessary.

Excavation of foundations was done with a steam dragline machine on crawler traction and handling a 1-yd. clamshell bucket for soft material and a dragline bucket for firm material and for backfilling. The same machine drove the sheeting and foundation piles by means of a steam hammer in leads suspended from the

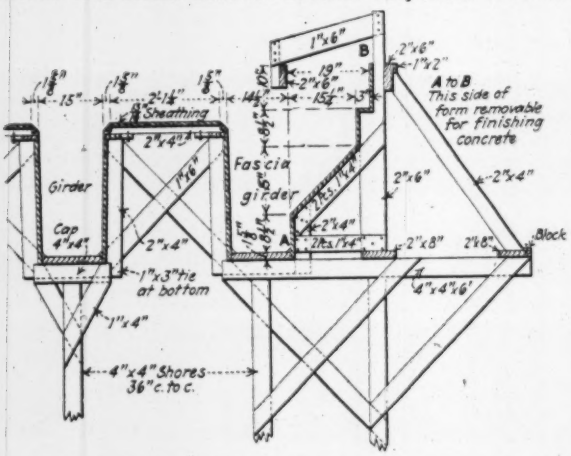


FIG. 5—BRIDGE FORM HAS REMOVABLE SIDE
To permit the finishing treatment of exposed concrete surfaces the outer sides of form can be taken down without disturbing the shores or supports.

boom; it also pulled the sheeting. Steel reinforcement, delivered cut and bent to shape, was wired up in units on the work. A total concrete quantity of 8,600 cu.yd. was required and each typical 38-ft. span averages 220 yd. for footings, piers, span and parapets. The work required also 363 tons of reinforcing steel and 367 tons of structural steel.

Practically all concrete was made in a ½-yd. gasoline mixer having a drum of the vertical-axis type discharging into a small cable-operated car running on an inclined track forming part of the outfit. The movement of this car was controlled by the mixer operator. At the head of the incline the car dumped its load automatically into the hopper of an inclined chute, the concrete being then delivered directly to the forms. This concreting plant, shown in Fig. 4, was mounted on road wheels and moved from site to site under its own power. The footings and piers were poured first; then the girders, in three-span units, and finally the intermediate portions of the parapets. The surface of the roadway slab was finished by floating to give a hard dense surface to resist wear.

Formwork for the spans, shown in Fig. 5, was designed specially for re-use, in view of the frequent repetition of identical 38-ft. spans. It was also designed to permit easy removal of the form for the face of the outer girder while leaving all falsework in place. This feature was necessary to meet the requirement for surface finish. It will be noted that this part of the form is carried by an extension of the falsework sill under the girder, so that the side of the form can be removed without disturbing this sill or the bottom support of the girder.

Under each interior girder there was a single row of posts 3 ft. c. to c. with knee braces to short caps. Upon these caps were placed the trough-shaped girder forms, with sides supported by bracing, no interior wiring being used. Since the ground was soft and would become mud after rain, the posts and their bottom blocks and wedges were seated on a continuous mat or grillage of planking, in two courses, in order to give a solid base and to distribute the pressure.

An average of 150 men were employed by the concrete contractor and worked 10-hour days, except that concrete pouring of any unit had to proceed continuously until finished. Carpenters only worked 8 hours a day. No camp or commissary arrangements were necessary, the men living at the nearest town and two motor cars taking them to and from work. Many of the carpenters and laborers lived at home and rode in their own cars. For transporting material, the contractor made arrangements with a local trucker to unload all cement, sand, gravel, steel bars and other supplies at the nearest railway point and to deliver them at the work for a fixed price per ton or per sack. The unloading from cars was done by hand.

Concrete and Surface Finish—Gravel concrete was used throughout, with a mix of about 1:2½:4 for the footings and piers and 1:2:3½ for the spans, the cement content being specified definitely. For the spans, 8 lb. of hydrated lime per sack of cement was added in order to give a dense mix with sufficient plasticity to flow readily around the reinforcing steel and also to show a white surface in the concrete when cured. The concrete was continually spaded and rodded while being placed, while particular care was taken to keep it at a uniform level in the forms.

An unusual feature for country road bridges of this class is that all surfaces exposed to view are finished by rubbing with carborundum, except that the panels on parapet walls are bush-hammered to expose the aggregates. For this treatment the side forms are removed in 24 hours and the surface is rubbed with wood floats to remove all form marks and loose cement skin. When the concrete has cured for ten days or more the process is repeated, but with carborundum blocks. No cement or grout is used but only clean water, the effect being to work up a white lather. After a day or two, when the lather has dried, the surface is wiped with burlap to remove all dust and polishing marks. This finish, costing about 10c. per square foot, gives the concrete a clear white color instead of the usual dull gray of common concrete.

Construction was commenced Sept. 1, 1923, and was to have been completed by Dec. 15, 1924, but progress was retarded by bad weather during the winter and spring and by the foundation difficulties. All concreting, however, was finished before severe cold weather. For the concrete on this series of bridges the contractor was the F. K. Vaughn Building Co., Hamilton, Ohio, the work being in charge of Harry S. Marshall, vice-president, with W. H. Kirven as superintendent of construction. All steel spans were built and erected by the Vincennes Bridge Co., Vincennes, Ind. Design and construction were all under the direction of William J. Titus, bridge engineer, Indiana State Highway Department, and the construction work was in direct charge of W. R. Britton, district bridge engineer. The total cost will be about $273,340 for the bridges complete and $359,340 including the heavy embankment work for the road but exclusive of the roadway slab.

Changes in Cement Imminent in Germany

Meeting of German Portland Cement Manufacturers Shows That High-Grade Cements Are Becoming Important

REPORTS of the annual meeting of the German Portland Cement Association at Berlin on March 11-13, 1925, indicate that the manufacturers of cement there are making a most intensive study of the so-called high-grade portland cements, that is, cements that will give early (1- to 2-day) strengths comparable to the alumina cements recently put on the market. The chairman reported that scientific investigation has been active in this field and it seems that it will result in new discoveries and show new paths to better accomplishment.

Revision of Standards—A final report on the activities of the committee on standards and proposed changes from the present standards could not be given, because not enough has been learned in the field of high-grade portland cements, and investigations in that field have not yet been concluded. The presentation of a new set of standards would, therefore, in the opinion of the committee be premature; it was advisable to await the results of the tests now being made in order to be able to provide standards for high-grade cements also. However, the results already obtained justify proposing figures for the minimum strength of high-grade portland cement under compression, namely 250 kg. (3,550 lb. per sq.in.) after 3 days, and 450 kg. (6,390 lb. per sq.in.) after 28 days combined setting.

In the discussion which followed it was proposed to set temperature limits within which these hardening tests must be conducted. In the case of these high-grade cements the strength figures depend to a large extent on the temperature, a fact not previously taken into account. Entirely different figures are obtained for high-grade cements depending on whether they are allowed to harden at 10 to 12 deg. C. or at 15 to 18 deg. C. Great care must be taken not to assume that the figures obtained in the laboratory will represent actual conditions in the field exactly. It was pointed out that a bill proposed by the Ministry of Communications called for a strength test not of 450 kg. (6,390 lb. per sq.in.) after 28 days but of 500 kg. (7,100 lb. per sq.in.).

Laboratory Activities—Dr. G. Haegermann gave the report on activities of the association's laboratory. He said that the results on general cement testing, both for standard portland cements and for high-grade cements, had been gathered into a comparative table. This table showed that in the case of the 159 standard type portland cement samples tested in the year 1924 the retention on the screen was on the average less than for the previous years. The specific weight of portland cement has remained unaltered for the past ten years. The binding properties were the same as for the year before, but the strength values showed an increase in certain respects. The average value of the strength under compression after 28 days setting under water was 344 kg. (4,885 lb. per sq.in.) and after 28 days combined setting 382 kg. (5,425 lb. per sq.in.). The tests show that 78 per cent of all the plants are in a position to manufacture a portland cement which will show a strength test of over 350 kg. (4,970 lb. per sq.in.) after 28 days setting. In the matter of the high-grade portland cements, whereas only two mills were manufacturing this product in 1923, by September, 1924, fifteen works were engaged in manufacturing such cement. Special cements are now being manufactured which after 3 days setting under water show a strength of 400 kg. (5,680 lb. per sq.in.) and after 28 days combined setting a strength of over 700 kg. (9,940 lb. sq.in.). This is a distinct advance. The tensile strength also increases with increasing strength under compression. In any case, high-grade portland cements are now in a stage of active development.

Strength tests with alumina cements show that the compression strengths are very high, but the tensile strengths are lower than those for high-grade portland cements. Blast furnace and slag cements were investigated and experiments were conducted on the utilization of ashes and lignite slags. A series of tests was made on high-grade portland cements, in which it was found that one part of high-grade cement costs as much as 1½ parts of ordinary cement. Investigations were made to determine whether mixtures of one part of high-grade cement with sand showed the same properties as the mixtures with 1½ parts of ordinary cement. Equivalent results were obtained with one brand, but in the case of other brands the results were not so good.

Standard Tests—One part of the discussion was devoted to the standard tests for cement. Comment was made on the variability which results from variation of testing room temperature. It was stated, too, that screen tests could make no claim to exactitude and that variation in the methods of tempering the test pieces did not conduce to certainty of result. Finally, doubt was expressed as to the suitability of the standard sand for testing. It was stated that all other countries have a larger proportion of fine sand in their standard sand, and it may be that the higher strength figures obtained, for example, in Holland, Switzerland and many other countries are to be ascribed not only to different methods of testing but also to the different standard sand. It was remarked that in selecting the German standard sand attention was not devoted to obtaining the best strength figures but merely to finding the most suitable sand. The standard methods result in obtaining unified testing methods which have nothing to do with the magnitude of the strength figures.

Dr. H. Kühl of the government laboratory at Berlin-Lichterfelde discussed the problem of cement testing without regard to the problem of cement standards. There is a large range of properties which are not standardized as, for instance, resistance to chemical attack and against mechanical wear. Fineness is included in the standards, but we are approaching the time when the determination of fineness by screen tests alone will no longer be possible. Screening data are no longer comparable if the cements are ground in different types of mills. Air separation has not found application in the laboratory owing to the fact that the apparatus has not been sufficiently developed. The sedimentation method with alcohol is too complicated for use in the plant. Another method for the investigation of the fine particles of cement is indicated in a proposal in which the surface of a substance absorbs radioactive substances more strongly the finer the particles of the absorbing substance are. The cement could be shaken up with an alcoholic solution of a radioactive substance and in this way the fineness of the particle determined.

One of a Series of Articles on the Details of Design and Layout of Different Types of Industrial Buildings

Reinforced-Concrete Wood-Pulp Paper Mill in Oregon

Burned Mill Is Rebuilt in a Few Months—Steel Columns in First Story Save Floor Space—Wood Roof and Sash on Account of Humidity in Paper-Machine Room

By E. L. Williams
Consulting Structural Engineer, Portland, Ore.

IN REBUILDING Mill 1 of the Hawley Pulp & Paper Co.'s plant at Oregon City, Ore., rapid design and construction were special factors in order to meet emergency conditions. The old mill was completely destroyed by fire on Oct. 8 and 9, 1923, but in about ten months it had been replaced with a modern, reinforced-concrete structure, and was turning out finished products at the rate of 45 tons per day. On Oct. 15 the plans for the new building had been started; by Nov. 15, construction was well under way; on April 1, 1924, the machine-room building was completed and the installation of machinery had begun, while on July 15 the mill was put in full operation. Fig. 1 shows the south end of the completed plant.

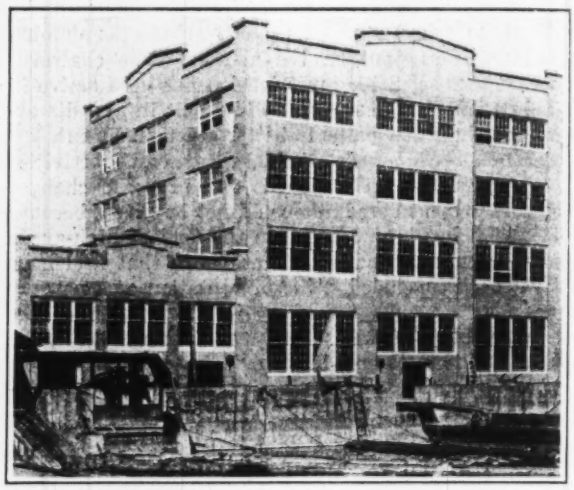


FIG. 1—WOOD-PULP PAPER MILL

Proposed Steel Design—Before the fire, this mill unit consisted of old frame buildings which had been used as a flour mill and had been repaired and reinforced from time to time with heavy timbers to withstand the heavy loads and vibration from the paper machinery. It had been the original intention of the owners to rebuild the plant with structural-steel frame and concrete walls and floors. Since the plant was to be kept in operation as the work proceeded, the selection of structural steel was due to the necessity of transferring the loads of floors and columns as quickly as possible to the new members and avoiding all interference with operating machinery. The performance of this work had been somewhat difficult under the conditions. All data and measurements had to be secured during the operation of machinery, and the placing of structural-steel members had to be done in a piecemeal manner. Work was being carried out on this basis, and the basement columns and first floor framing had been put in place when the fire occurred.

Reinforced-Concrete Design—Steps were taken immediately to replace the mill, and reinforced-concrete construction of the slab and girder type was adopted. The new mill consists of a four-story and basement beater-engine building, 78x78 ft.; a one-story and basement paper-machine building, 202x42 ft., and a one-story boiler house, 30x45 ft., as shown by the section and elevation, Fig. 2. This unit of the Hawley plant performs refining operations only. Sulphite and ground wood pulp are received from other units and are here put through deckers, beating engines, jordans and screens, and finally through the paper machine. Economic considerations required that heavy machinery be located on the ground or first floor, the upper floors being used for winding and cutting machinery and the

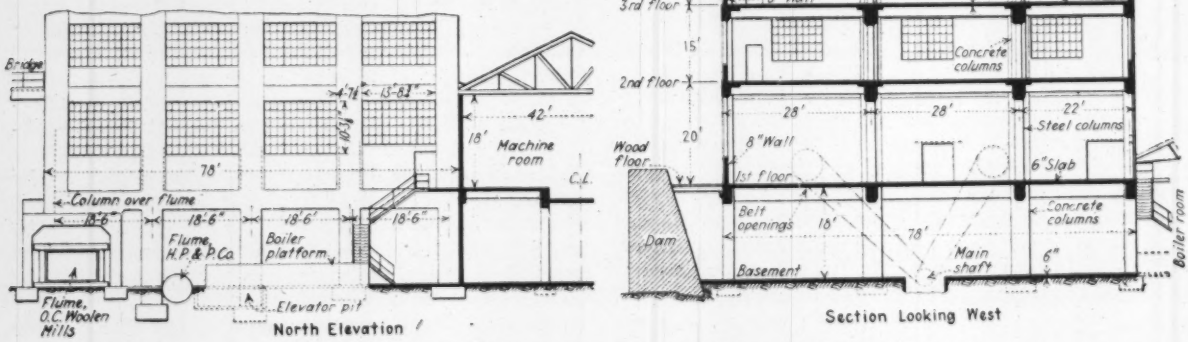


FIG. 2—THE HAWLEY PAPER MILL, OREGON CITY, ORE.

storage of the finished product. This plan was generally followed in the design of the mill.

Beater-Engine Building—In this building, the hydraulic-turbine drive operating the beater engines

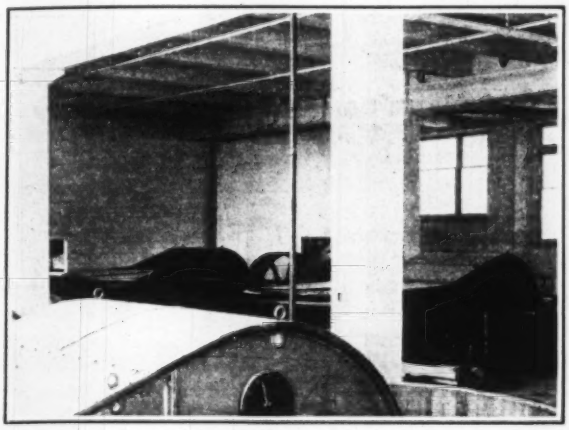


FIG. 3—BEATER ROOM ON FIRST FLOOR
Note U-bolts in beams for hoisting tackle in handling machinery.

is located in the basement, which was made 18 ft. high to allow ample height for the stock chests, which are located below the beater engines so that the contents of the latter may be discharged directly into the chests. The location of machines on the first floor determined the proper spacing of columns, which worked out for panels 24x28 ft.

To gain all available floor space, the first-story columns were reduced in section by making them of structural steel. Concrete wall columns were made rectangular in shape, with a double system of spiral reinforcing, in order to gain floor space. The location of beater engines with their belt drives also made necessary the unsymmetrical spacing of interior columns. This was taken care of in the outside elevations by constructing false columns or pilasters so as to give a symmetrical appearance, as indicated by the small portion of plan in Fig. 4.

For the first floor there is a 6-in. slab designed for a live-load of 500 lb. per sq.ft. This heavy construction practically eliminated vibration from machinery, while to further stiffen the floor under the beater rolls, cross-beams 12x24 in. were placed on the center line of rolls in the floor framing. Provision for repair of machines and quick removal of parts was provided by embedding heavy U-bolts in the floor framing above all machines and above lines of drive shafting, as shown in Fig. 3. The height of the first story was made 20 ft. in order to put the second floor on a level with the loading platform of a railroad siding; otherwise 15 ft. probably would have been ample height. Windows were made full width of panels between columns.

On the second floor is located winding and cutting machinery; here also the finished product is cut and wrapped for shipping. These products are conveyed to the railroad siding by an overhead bridge. The height of this story was made 15 ft. in order to give ample clearance for the cutting machinery. The third and fourth floors are used for storage of finished products and for materials required in the manufacture of paper. Typical floor construction is shown in Fig. 4. All upper floors were designed for a 275-lb. live-load and have 5-in. slabs. These stories were made 13 ft. high. A 5,000-lb. elevator conveys materials between the various floors.

Steel Columns and Framing—The steel interior columns used in the first story of the building to save floor space, as noted above and shown in Fig. 5, are of H-section, each built up of a web plate, two side plates and four interior angles. After erection they were wrapped with wire mesh and given a 3-in. casing of concrete, making a finished section 20x24 in., as compared with 36x36-in. for a concrete column. The steel column bases are embedded in the tops of the 40x40-in. reinforced-concrete basement columns, the base plates being secured by long hook-end anchor bolts. On the top of each steel column is a cap with top plate the same size as the concrete columns above, this cap carry-

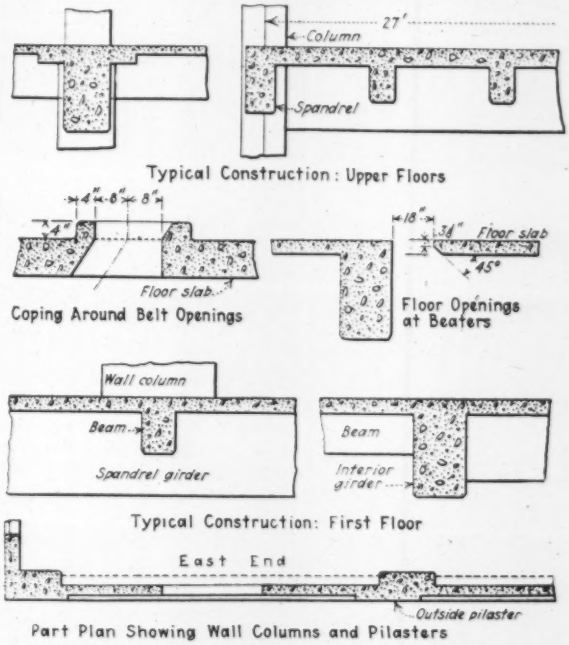


FIG. 4—TYPICAL FLOOR CONSTRUCTION
Floor openings for driving belts and other purposes. Small plan shows eccentric arrangement of wall columns and exterior pilasters.

ing the lower ends of 1½-in. anchor rods whose upper hooked ends are embedded in the second-story concrete columns. These anchor rods are used to give continuity between the steel column and the concrete columns above and below it. The ends of the vertical reinforcing rods are milled to bear against the base and cap plates of the steel column. Holes in the base plate permitted the concrete to flow under the base and give the column a full bearing. Shelf angles support the concrete beams and girders of the second floor, reinforcing bars hooked to anchors on the steel columns being placed at the bottom of both beams and girders to assure the continuity otherwise broken by the steel column. Concrete knee-braces enclose these rods which extend below the shallower floorbeams.

Another interesting detail was due to the necessity of carrying columns at the east end over a wooden flume 5½x10 ft. running diagonally under the floor to the plant of the Oregon City Woolen Mills. This was accomplished by placing structural-steel frames

encased in concrete, as shown in Fig. 6, the work being done without interfering with the operation of the flume. It will be seen that the columns are seated on a grillage supported by a rectangular frame of four plate girders on columns outside the line of the flume.

Paper-Machine Building—In designing this structure, its length and width were determined by working clearances required for the operation of the paper machine. In the basement are located a 400-hp. hydraulic turbine to drive the beating engines in the adjacent building, a 500-hp. uniflow steam engine, pumping machinery, generator, and a variable-speed motor which drives the paper machine. Provision was made in the first floor framing to permit the electrical machinery to be lifted above the basement floor during unusually high stages of water level, which occur at approximate intervals of three to five years. As it was not convenient to locate framing members in the first floor of the machine room, over the generator and motor in the basement, openings 6x6 in. were formed in the floor slab so that hoisting cables can be attached to the machines and carried up to chain blocks or hoists suspended from the roof trusses.

The paper machine is located on the first floor on a special foundation. This floor was figured for a 500-lb. live-load with a 6-in. slab. Roof trusses giving a clear headroom of 18 ft. span the full width of the building and were designed for the roof load and for possible concentrations of 10-ton loads at any point. These live-loads are due to the use of trolley hoists on

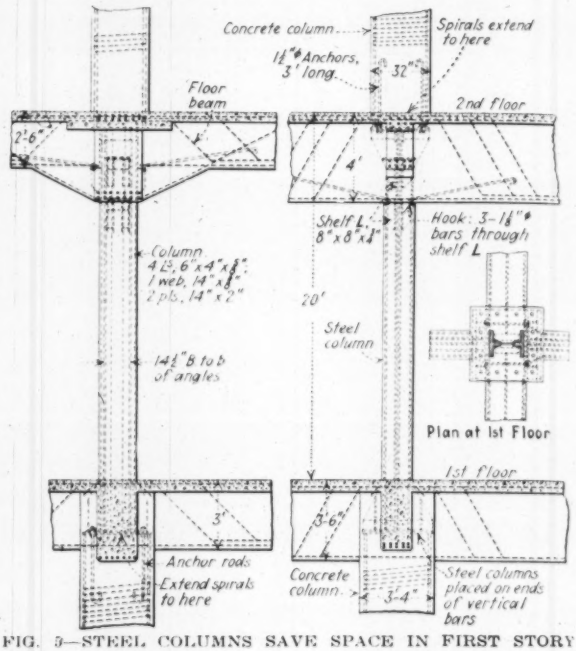


FIG. 5—STEEL COLUMNS SAVE SPACE IN FIRST STORY

the trusses for removing paper machine rolls and parts of the machines for repairs. Wooden trusses were selected as having greater durability on account of moisture from condensation.

Particular attention had to be given to the matter of condensation and ventilation owing to the great humidity in a paper-machine building. To reduce condensation, the roof is of wood plank with a heavy covering of four-ply 14-lb. roofing felt. Over the wet end of the machine are 30-in. circular ventilators placed 24 ft. apart along the apex of the roof. Over the drier rolls or middle section of the machine is a large continuous ventilator or monitor with a suspended hood which extends entirely over the rolls and is close above them. At the finishing end of the machine, steam heating pipe coils are placed in a horizontal plane directly below the roof trusses in order to dry the atmosphere as much as possible, since condensation is extremely objectionable at this stage of paper making.

Machine-room buildings for paper mills in this vicinity are generally one-story structures. Such buildings with upper floors probably would not be economical,

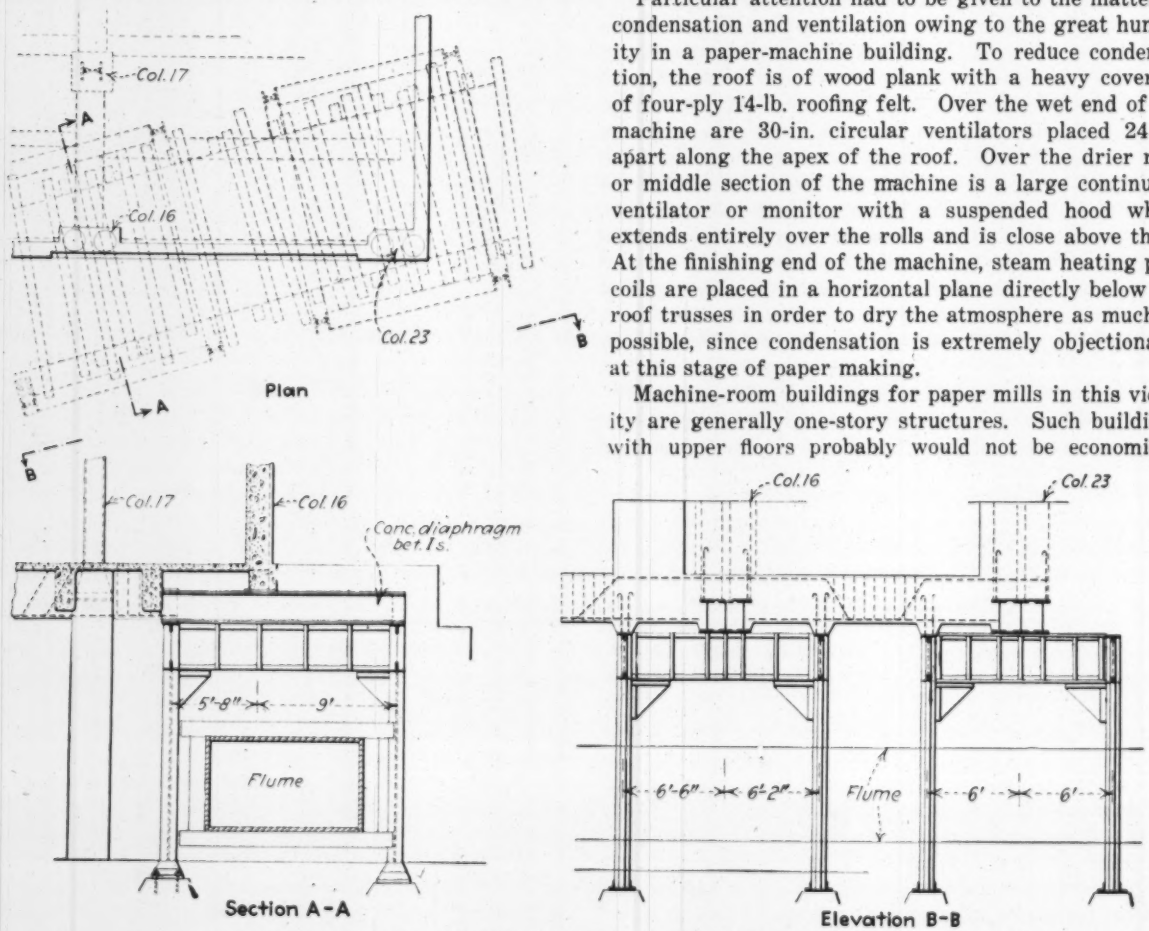


FIG. 6—STEEL FRAMING SUPPORTS BUILDING OVER FLUME

as the floor framing would have to span the entire width of the machine room, while floor space would have to be sacrificed on account of the necessity of providing ventilators or shafts to the roof to carry off vapors from the machine room. And as a rule it would not be convenient or economical to place the machine room on an upper floor.

Miscellaneous Features—All floor slabs are given a ¾-in. cement finish, troweled to a hard dense surface. This finish was applied after the slab had been cleaned with a dilute solution of muriatic acid, then brushed and finally washed with water. For the ceilings and interior walls, a patented white paint composed of portland cement and linseed oil was applied with a spraying device. A brush coat of liquid portland cement was also given to the exterior surfaces. Curtain walls between columns and spandrel beams are 8 in. thick, reinforced with ½-in. round rods spaced 24 in. c. to c. in both directions. Ample lighting is obtained by skylights over the machine room and large areas of window space in both buildings. Wood sash and clear glass are used throughout on account of the greater resistance of wood to moisture effects. A sprinkler system is installed throughout both buildings for fire protection.

This paper mill was designed by the writer, many valuable suggestions as to special features being given by Willard P. Hawley, owner of the plant. A. Guthrie & Co., St. Paul and Chicago, were the contractors, with C. P. Richards as their field construction engineer.

Scientific Control of Concrete Shows Economy

Application of Fineness-Modulus Theory on Building Gives Uniform Concrete and Saves Considerable Money

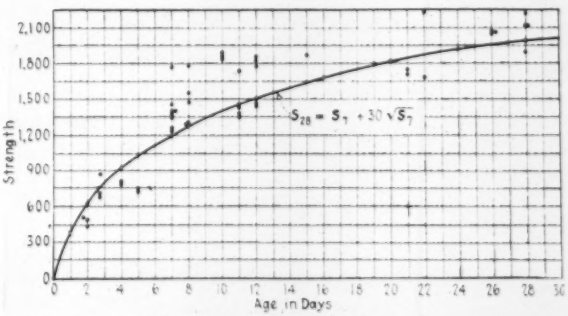
By ELWYN E. SEELYE
Consulting Engineer, New York City.

THE PRACTICING engineer, while convinced of the *theoretical* soundness of the newer theories of proportioning concrete mixes has evinced great hesitation in applying them because of some doubts as to their practicability. Many have felt: (1) that the analysis and computations required appear highly technical; (2) that the designed mix may turn out to be too harsh, requiring arbitrary changes; (3) that the benefits obtained from a stiff mix appear at first sight to be offset by difficulty in working the concrete into the forms and around the steel; (4) that the intelligent and loyal co-operation of the contractor's field force would seem difficult to obtain; and (5) that the use of these methods requires engineering supervision of a type difficult to obtain.

These considerations led the writer to study a particular case to determine what his attitude toward scientific concrete control should be on future work. The Finkenberg warehouse, which was selected, is a six-story reinforced-concrete flat-slab structure located at 134th and Willow Sts., New York City, and was built in the fall and winter of 1924-25.

When the contract was signed it was agreed that the contractor might make use of scientific control methods and he was permitted to anticipate certain savings to be obtained thereby in making his bid with the proviso that the 28-day strengths of the concrete should not fall below 2,000 lb. per sq.in. By this arrangement it is seen that both the owner and the contractor participated in the savings effected and it is said to have resulted in the concrete foreman's showing keen interest in keeping down the water content, as he was aware that he was by this method reducing the amount of cement required.

It should be noted that in this case it was fitting that the contractor should share in the savings because he



ACTUAL COMPRESSIVE STRENGTH OF TEST PIECES COMPARED WITH PROBABILITY CURVE

furnished the motive power behind the attempt to use scientific control. On the other hand in judging the practicability of using these methods it is well to bear in mind that one of the partners in the contracting firm is an engineer who has carried out and published the results of valuable research work along these lines, and consequently his field men may be more than usually well trained for this specialty.

Methods Used—It was decided to apply the fineness-modulus method of proportioning, devised by Prof. Duff A. Abrams and made familiar in the publications of the Structural Materials Laboratory.

The aggregate was a ready mix of a brand much in use in the vicinity of New York City. The fineness-modulus determinations for a representative week varied between 5.97 and 5.48, as shown in the accompanying table. The cement factor was computed from the fineness-modulus and required strength by the usual formulas and a close check on the results by means of test cylinders.

COMPRESSIVE STRENGTH OF CONCRETE TAKEN FROM BUILDING UNDER CONSTRUCTION

Fineness modulus of ready mixed aggregate shown and compressive strength of 6 x 12-in. cylinders.

Cyl. No.	Age, Days	Location	Fin. Mod.	Mix, Actual	Slump, In.	Strengths Estimated	Strengths Actual	Strengths 7 Days	Strengths 28 Days	Strengths 90 Days
11	28	2nd Fl. Slab	5.70	1:6.25	..	2,000	2,110	1,265	2,110	2,470
16	28	Slab	5.70	1:6.25	..	2,000	1,880	1,130	1,880	2,200
21	26	Slab	5.48	1:6.25	7½	1,970	2,064	1,260	2,100	2,460
22	26	Slab	5.48	1:6.25	7½	1,970	2,050	1,300	2,085	2,440
32	15	Hand Mix Same as 3rd Fl. Slab	5.74	1:6.5	5½	1,640	1,860	1,360	2,270	2,660
41	12	Ext. 2nd Story Col.	5.97	1:6.5	6½	1,500	1,845	1,475	2,460	2,875
45	12	3rd Fl. Slab	5.97	1:6.5	6½	1,500	1,432	1,145	1,910	2,235
44	11	3rd Fl. Slab	5.60	1:6.5	6½	1,450	1,370	1,135	1,890	2,210
49	10	3rd Fl. Slab	5.73	1:6.5	6	1,400	1,880	1,610	2,685	3,140
50	10	3rd Fl. Slab	5.73	1:6.5	6	1,400	1,830	1,570	2,615	3,060
54	10	3rd Fl. Slab	5.73	1:6.5	6	1,400	1,850	1,585	2,640	3,085
23	5	2nd Fl. Slab	5.74	1:6.5	6½	1,040	1,186	1,370	2,270	2,660
24	5	2nd Fl. Slab	5.74	1:6.5	6½	1,040	1,120	1,290	2,150	2,520
Average of slab concrete							1,215	2,017	2,360	

In order to keep close tab on the strength of the mix, cylinders were broken at early dates from an age of 2¾ days and the 28-day strengths predicted from the probability curve, shown in Fig. 2. This curve is based on the formula $S_n = S_7 + 30\sqrt{S_7}$, suggested by the Bureau of Standards (*Engineering News-Record*, Nov. 27, 1924, p. 897). From predictions made by the use of the curve and reducing the slump it was found to be possible to reduce the initial cement factor of 1.25 to 1.16 and resulted in an average cement factor of 1.18.

Economies Shown—Here is where the interest of the concrete foreman in the results bore fruit. Assuming that under ordinary conditions of arbitrary proportions the cement factor would be 1.45, as the quantity of concrete involved was 7,000 cu.yd. the saving as compared with ordinary methods was as follows:

$$1.45 - 1.18 = 0.27$$

$$7{,}000 \times 0.27 = 1{,}890 \text{ bbl.}$$

Assuming cement cost in concrete at $3 per bbl. we have a saving of

$$1{,}890 \times \$3 = \$5{,}670$$

The cost of expert supervision, and the making and breaking of cylinders was about $950. Hence the net saving was $4,720, or 67c. per cu.yd.

This saving of 67c. per cu.yd. is only apparent because there are other factors which may increase or decrease it as follows:

1. The uniformity of the strengths and the high early strengths enabled early stripping of forms and resulted in a further saving. This saving was the more marked because, the work being conducted in winter weather, it reduced the time necessary for enclosure.

2. The writer has been for years receiving the results of tests from many 1:2:4 jobs and confidently states that 1,800 lb. at 28 days would be a high average for uncontrolled work. Were the uncontrolled job to be required to average 2,000 lb. a much richer mix would be required, a cement factor of 1.6 might result.

This would result in a difference in cost between 2,000 lb. concrete by the arbitrary ratio method (uncontrolled slump) and by this method of $1.20 per cu.yd.

Conclusions—The use of scientific control methods in mixing concrete presents such large possibilities in both saving on cost and improvement in uniformity and quality that the engineer or architect of today cannot properly fulfill his duty to his clients if he neglects to use these methods.

The use of uncontrolled concrete, in reinforced-concrete construction, designed under present accepted working stresses has been proved by experience to be at least as safe as steel construction (eliminating accidents during the construction period due to faulty methods with which the assumed working stresses have no connection). Therefore scientifically controlled concrete may be safely designed with higher working stresses than are now in vogue.

There is a grave danger of abuse of these methods by the ignorant or unscrupulous.

Another point worthy of note is that it was found to be actually easier to attain good workmanship with a slump of about 5 in. than it is with a wet mix, because the natural segregation of the latter requires special care.

The architect of the building was Frank E. Hahn, the contractors were Barney-Ahlers Construction Corp., and the design of the mix was in charge of George Conahey, then of the Portland Cement Association, but at present associated with the writer.

Federal Aid Denied Day-Labor Road Work in Arizona

Losses on Earlier Day-Labor Work by State Forces So Great That Federal Officials Refuse Further Aid

By Thomas H. Macdonald
Chief, U. S. Bureau of Public Roads, Washington, D. C.

The ensuing statement by Mr. Macdonald is in response to an inquiry by "Engineering News-Record," and repeats largely, but extends, the official statement made public in the Arizona newspapers and elsewhere.—Editor.

THE ROAD project in Arizona on which question as to further federal aid has arisen is Federal Aid Project 72-B which consists of nine miles of grading and part surfacing between Congress Junction and the south end of Project 72-A, the latter a project which is now under contract construction and which runs 18.8 miles north to the Prescott-White Spar Forest project. The situation is substantially as follows: At the request of the State Highway Department, the bureau has previously consented to the construction of three projects on the day labor basis. These projects, which are now under construction, are as follows:

1. Project 77, twelve miles, between Solomonville and Duncan in Graham County, for which agreement was executed Feb. 26, 1924, for $80,125.

2. Project 74, twenty miles of the National Old Trails Highway between Canyon Diablo and Navajo County line, Coconino County, under agreement of Sept. 23, 1924, for $102,081.

3. Project 69, twenty-two miles of the Phoenix-Yuma road between Piedra and the Yuma County line in Maricopa County, under agreement of Oct. 23, 1923, for $137,627.

While I believe it is an established general principle that day-labor construction of highways is not economical, it is possible in specific cases that certain conditions, if existing, may justify a state in undertaking to construct a road with its own forces, but in no case is the adoption of the day labor plan as a general policy justifiable from the standpoint of public policy or economy. In order that the day-labor plan might have a fair trial in Arizona, the bureau concurred with the state in undertaking the above listed projects on a day-labor basis in 1924.

The question of the continuance of this day-labor or force-account practice has now arisen in connection with the construction of Project 72-B. Bids for this project were opened Jan. 26, 1925. The engineer's basic estimate of cost was $242,318 and of five bids submitted the low bid was $162,612 by Schmidt & Hitchcock and the next lowest bid was $210,196 by Henry Galbraith. The State Highway Department and the Governor verbally requested that the state be allowed to construct the project with day labor instead of awarding the contract to the low bidder. It will be noted that the two contractors submitted bids well below the state engineer's estimate of a fair price, the low bid being $80,000 under the estimate. It may well be questioned whether the low bid was not too low, but there still remains a bid $32,000 under the state's estimate, so that there can be no question that keen competition was had.

In the long run the price that the people of Arizona

pay for road work will depend on the maintenance of competition by the contractors, and this in turn depends upon fair and just dealing with the contractors by the state.

In September, 1924, the bureau asked for the installation of a cost accounting system on Arizona 74, but we have not received the actual cost of the projects already under day-labor construction. Regular periodical inspections by the bureau engineers and reports received from these projects convince us, however, that there has already been a considerable loss to the state. There is no financial loss to the federal government for the reason that the state agrees in each instance to undertake construction on a unit cost basis, and consequently the excess cost is an apparent loss to the state. It is believed that the excess cost on these projects already amounts to a very large sum. The state's portion of federal aid cost comes largely from funds allocated to the counties, so that losses actually must be made up by money allotted to the corresponding county. Thus the amount of highways that can be built from the federal appropriations and the funds allocated to the several counties are correspondingly decreased.

It is not, therefore, a question of the bureau's desire to interfere with or harass the Arizona Highway Department, but rather a question of whether the bureau can become a party to the continuation by the State Highway Department in respect to federal aid construction, of the policy which involves a higher cost for roads than is necessary. The State Highway Department concedes that the state is unable to do day-labor work as cheaply as indicated by the proposal of the low bidders on Project 72-B, who secured bond and wished to enter a contract.

Occasionally the idea comes to the surface that federal aid funds are distributed to the states to be used as the state pleases. No more mistaken idea could exist. The federal appropriations are made for the accomplishment of certain specific purposes, and the federal supervision is established to make sure that the funds are devoted to these purposes. Congress scrutinizes very carefully the operations of this bureau in the use of these funds. The policy of federal assistance in road building has from time to time received severe criticism, but it is this policy which has made road building possible in many states, and particularly in states in the West. This bureau is committed to a program of economy and efficient administration that will not bring under the faintest cloud the expenditure of these funds. No item that will contribute toward the scrupulous efficiency and economy in the construction of the federal aid highway system will be neglected. The bureau has made a major point of economy of operation in its own organization, and expects no less from the states in so far as the expenditure of federal aid funds is involved.

Arizona by its rejection of the very favorable bids, defeated the possibility of going ahead with this project at once. Rejection of these bids was over the protest of this bureau, and this protest was in part based upon the fact that the bureau believes this to be one of the most important projects in the state, and there is no doubt that its completion would have been hastened if a contract had been awarded when bids were received. The state had an opportunity to let a contract for this work on Jan. 26, and had this been done the contractor would no doubt have been on the job now. The bureau refuses any responsibility for the delay.

The bureau does not believe in attempting to secure work at prices lower than are reasonable, but we have already given the day-labor plan proposed by the state a fair trial by concurring in the adoption of the plan on the three projects referred to above, and from the best information the bureau has been able to secure the resulting cost of these projects has been so excessive that the bureau refuses to be a party to a continuance of this policy when reasonable bids are received.

Subsequent to its refusal to accept the low bid of Schmidt & Hitchcock, the state readvertised the project and five bids were opened on April 6. Schmidt & Hitchcock again were the low bidders and the contract has been awarded to them at $177,000, which is higher than their former bid but less than the next higher bid received in response to the first advertisement.

The responsibility with respect to the administration of the federal aid projects resting upon this bureau will be even greater in the future than at present. We have no desire to handicap a state in any way. We are ready to devote our best efforts to its service but we must insist that the federal funds be expended with the greatest possible economy under clean-cut business policies.

New Methods of Treating Industrial Waste

Abstract of paper read before Indiana Chapter, Lake Michigan Sanitation Congress, by Charles H. Hurd, Consulting Engineer, Indianapolis.

SOME of the most recent developments in sewage purification applicable to the treatment of industrial wastes are the methods known as flocculation and activated aero-filtration. In the flocculation method, which is partial activated-sludge treatment, advantage is taken of the dissolved oxygen contained in the inoculating sludge and of conditions favorable to biological activity, which produce very considerable nitrification within a relatively short period.

Activated aero-filtration, which has been developed by the author and which has also been used experimentally at the demonstration laboratory for the city of Moscow, Russia, by N. A. Basiakine and I. G. Povarnine under the direction of S. N. Stroganoff, chief of laboratory staff, shows considerable promise, both for the treatment of sewage and other organic wastes. This system is made up of deep filters or bacteria beds, provided with forced aeration or ventilation, upon which is sprayed, at a very high rate, sewage inoculated with aerobic bacteria. The inoculation may be produced by returning settled sludge either from secondary settling tanks or from flocculation which may precede aero-filtration. The results from the latter seem to be more positive and this process is likely to come into more general use. The probable advantage of the aero-filtration system is in the low cost of operation and the production of more easily dewatered sludge.

The perplexing problem in the treatment of industrial wastes, as in sewage, is the disposal of sludge. In many instances, as in paper mills and rubber reclaiming plants, the sludge recovered is a valuable product. The method of the treatment of sludge depends primarily upon the character of the sludge produced and upon the available means for disposal. If the sludge is mainly inorganic and settles or dries to a reasonably low water content, it may be deposited on low ground or in fills. If the sludge is organic and putrescible, it may be reduced in quantity and more readily handled by putting it through the process of digestion.

Separate sludge digestion has been used recently to advantage in connection with the disposal of activated sludge. While gasification proceeds slowly in the attempt to digest activated sludge alone, it becomes extremely active with mixtures of activated sludge and fresh plain settled sludge, inoculated with sludge returned from the digestion process. This method, with a means of decanting the supernatant liquids, gives large digestion capacity per tank unit and produces a final sludge which is easily dewatered and valuable as agricultural fertilizer.

Bridge Engineering Fifty Years Ago

Recollections Inspired by Recent Reference to Book on Continuous Drawbridges Published in 1875

By Clemens Herschel
Consulting Engineer, New York City

ONE of England's Public Schools, Harrow, I believe, has a school song, whose chorus "Twenty years, thirty years, forty years on," when heard anywhere, will bring an old Harrovian to his feet, in an ecstasy of loyalty and emotion. *Engineering News-Record* has exceeded this time period for causing pleasurable inspiration, by the creation of the column headed: "Engineering Fifty Years Ago," and as, in it, I have in the number for April 9, 1925, been given the questionable honor of appearing as a hoary- (or else, bald-) headed bridge engineer, I intend to give some 50-year-old bridge-builder reminiscences.

That title of the 50-year-old book, "Continuous Revolving Drawbridges," noted in the column as having been reviewed in an earlier volume, may serve as a text for an article of this sort on the condition of bridge building in the United States 50 years ago, and since, as experienced by the writer. Note the emphasis laid on the fact that the book relates to "panel" girders, and moreover "continuous" panel girders; and all this in the design of a "swing" bridge. Nobody would build aught but a panel truss in such a case now-a-days (unless for very short spans) as distinguished from a "lattice" girder. The very names, "panel truss" and "lattice girder" have become obsolete. But in 1875, recollections of Town's wooden lattice bridges were still rife, and in Europe were being incorporated in wrought iron, for bridges hundreds of feet in span, across the Rhine and elsewhere.

As a combined sidewalk railing and outside bridge girder, I built one on the Albany St. Bridge over the Boston and Worcester (now Boston & Albany) R.R. in 1867 (see Fig. 2), (long ago lost in the shuffle of street and railroad right-of-way widenings that have taken place in that neighborhood) but instinctively turned to panel trusses for all the other metal bridges I ever designed, thus anticipating the modes of bridge construction since then universally followed.

The book especially treats of "continuous" girders, at the time an obscure yet inviting subject. Swing draws have always been built either as continuous girders, or else as two simple spans, hung together over the center turntable.

For a fine example of the last-named mode of construction, see the Hackensack River draw, Pennsylvania R.R., New York to Manhattan Transfer. And in *Engineering* (of London) for Feb. 14 and March 21, 1873, is an account of the Point St. Bridge draw, Providence, R. I., 250 ft. long. This was built by Charles Macdonald, now past-president, American Society of Civil Engineers, later the founder and upbuilder of the Union Bridge Co. of fine renown, happily still with us at the age of 88. The bridge (still in use) at the time made quite a sensation on account of its having been built strictly as a continuous girder, and for other reasons.

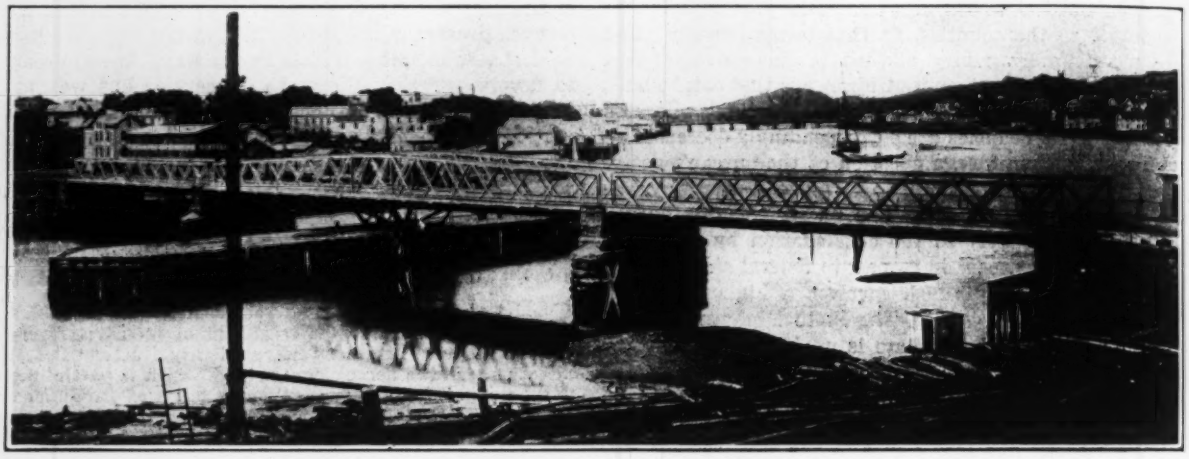


FIG. 1—QUINNIPIAC BRIDGE, NEW HAVEN, CONN., BUILT 1875, STILL IN USE
Note the design of the pier-heads; follows good engineering (not architects) design for such work, in spite of restrictions imposed by the use of draft-line stone cutting, or dimensioned stone only.

The Quinnipiac Bridge—To extend the solution of the problem which Macdonald solved—largely by experiment, on a model—I wrote the book under consideration, as soon as the same task faced me in the construction of the bridge across the Quinnipiac River, between New Haven and North Haven, Conn. And not to stint the work to be put into it, there were included in the discussion all possible cases I could think of, even to the extent of inventing the new one of the two center supports of the three spans being themselves supported on a beam, which is pivoted on a fifth support.

In its original form the book may be found in the *Transactions*, Am. Soc. C. E., 1874, p. 395. From the way it sold, in lots of a dozen or more, at intervals of about a year, I inferred that it was once used as a textbook.

Let me say right here, that from the time the Quinnipiac Bridge was opened to travel in 1875 until today I have never seen it. North Haven in 1874 was a sleepy New England town, whose principal export product, besides New Haven's morning milk, were blocks of red sandstone; some of them of considerable size and weight; whereby hangs a tale. The mayor of New Haven, and two of its "sober, steady citizens," formed one-half, numerically, of the Quinnipiac Bridge Commission, created to locate and build the bridge; and three similarly worthy burghers of North Haven

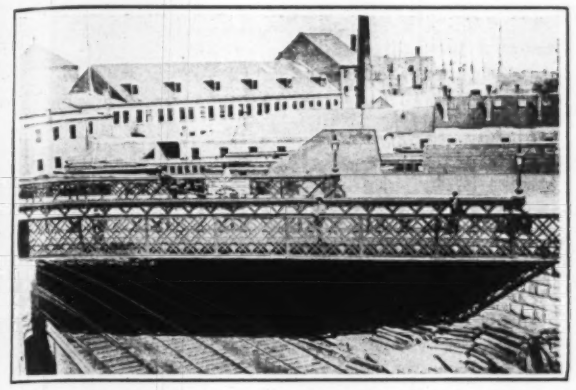


FIG. 2—HIGHWAY BRIDGE OVER BOSTON & WORCESTER TRACKS AT ALBANY BUILT 50 YEARS AGO

Note the lattice work pattern design, intended to please, and the special casting lamp-posts and acanthus leaved finials, at the ends of the main trusses. From top of planking, to under side of bridge is only 22 in.; cross girders 32 ft. long.

constituted the other half. Not being able to agree on a site for the bridge, as I remember it, and hearing of a youngster up in Boston who had the impudence to pretend to know "quite some" about bridge building, they made him the seventh commissioner. It resulted in the bridge that is there today (see Fig. 1); and in our book on swing bridges.

About that time I heard of a bright Yale tutor, lately returned from browsing upon knowledge in German engineering schools, by the name of Mansfield Merriman. He was from Southington, Conn., (possibly the only good thing that ever did come out of Southington). I thereupon promptly engaged him as an assistant, his first practical work, I believe; and as that wretched quadrilateral which had been surveyed to fix the length of the bridge and the pier positions would not balance up with precision, he, as promptly, did balance it by the "Method of Least Squares"; which in turn led to his lucid little book on that obscure subject; the beginning of the helpful work of that author and teacher, for the past 50 years. All of which belongs to the history of engineering hereabouts in 1875, running serially in your columns.

Time went along, "20 years, 30 years, 40 years on," when, just about 40 years after, I received a telephone call, and a voice, to this day nameless, inquired whether, as the engineer of Quinnipiac Bridge, I considered it safe for trolley cars. This was the first news I had had that trolley cars were pounding across the Quinnipiac on that bridge; hence I was considerably taken aback. I remembered that when trolley cars were first introduced, they seemed like veritable "cars of Juggernaut"; and necessitated a reconstruction of certain street railway tracks. Still, I said I would look it up, as 40 years after was too long to remember details. Happily, a certain 1874 computation book was still to be found, and it divulged the information that North Haven's sandstone quarries had furnished the test loading put at the basis of Quinnipiac Eridge computations. It was then the custom to transport the great blocks of stone, hung under the axle of two wheels some 10 ft. in diameter; and two such wheels and their load formed the basis of the 1874 cross girder computation. My unknown client did repeat his inquiry—repeated it in the same distant, elusive, manner as followed by him on his first inquiry; and was reassured, beyond his everyday observation, about the strength of Quinnipiac Bridge. Having thus "consulted" the builder, he disappeared; and, sad to relate, my fee for the consultation has to date disappeared with him. But the bridge is still there, I believe. Trolley cars, and 34,000-lb. auto-trucks, presumably, are going over it, and *Engineering News-Record* may have all of the above as an item in its 50-years-after survey and review—and welcome.

New Method Needed on New Zealand Railways

DECENTRALIZATION of management of the New Zealand Government Rys. and provision of funds independent of political control are two of the leading recommendations of the same British commission which recently investigated the government railways of New South Wales, as reported in *Engineering News-Record*, April 2, p. 560. It is considered that the Railway Department should be given full control of its own funds, all railway finance being separated from control of the Treasury Department.

The present railway organization is on the departmental system, but the report recommends a change to the divisional system, with greater individual responsibility, closer relations with the public, introduction of commercial methods and freedom from political pressure and control. Under the proposed system, which is said to meet the approval of the Minister of Railways, there would be a Railway Board composed of a chairman and two members in control of commercial affairs and operation respectively; the railways on each of the two islands would be in charge of a general superintendent, reporting to the Board and having under him three division superintendents, three district engineers and a mechanical engineer; the engineers would report through the general superintendent to the chief engineer and chief mechanical engineer. This plan is designed to substitute personal management for the present impersonal management by a distant headquarters staff; it is expected to eliminate many local grievances, improve direct relations with shippers and the public and give a much needed tightening up of management.

Considerable new construction required within the next decade will consist largely of branch lines, but one main link is needed to complete a continuous line through the South Island, and the report recommends the establishment of a train ferry to connect the railway systems of the two islands. Grade reduction and the double-tracking of some long tunnels are already planned. Track construction and maintenance are found to be of a high standard, but in order to reduce the maintenance cost on branch lines it is suggested that floating gangs be employed instead of large permanent section gangs. New main lines should have at least 70-lb. rail. Rail renewal on 100 miles per year is considered necessary. For some of the long heavy grades requiring special operation, the use of articulated locomotives is suggested by the commission. Repair shop practice is antiquated; small shop plants should be abandoned and the work concentrated. Purchase of new locomotives is considered preferable to construction in the railway shops. Passenger and freight cars, of obsolete types, need standardizing.

The New Zealand Government Rys. comprise 3,053 miles of line, with 3,942 miles of track, all of 3½-ft. gage.

Proposed Experimental Arch Dam On Stevenson Creek

Design Worked Out to Show How Cantilever and Arch Elements Act—Cantilever Should Fail at First Filling

DESIGN sketches of the experimental arch dam to be built on Stevenson Creek, in southern California, by the Committee on Arch Dam Investigation of Engineering Foundation have just been made available and are reproduced herewith. Alfred D. Flinn, Director of Engineering Foundation, states that it is planned to build the dam ultimately 100 ft. high, but the first test will be made at 60-ft. height. Of the total fund of $100,000, about two-thirds have been subscribed, which is sufficient to build and test the 60-ft. dam; the remainder is required for the construction to full final height.

Stevenson Creek, a tributary of the San Joaquin River, is about 60 miles east of Fresno. The gorge is sharply V-shaped in granite rock, and slopes steeply. The reservoir formed by the dam will be of such small capacity that in case the dam fails the sudden release of the water can do no damage below. An outlet of the main water-supply conduit of the Southern California Edison Co. is directly above the dam site. The intention is to excavate the bottom of the gorge at the site to a true V-shaped profile, slightly rounded at the bottom.

Much discussion centered on the design of the test dam. The section shown was finally agreed upon by the committee. The dam is to be of single-arch type, with vertical upstream face and constant upstream radius of 100 ft. On the second lift, a gravity tangent abutment will be constructed at one end, to give information on the transmission of the arch reactions to such an abutment.

The design assumes combined cantilever and arch action. Had the tensile stresses in the cantilever been limited to ordinary values, however, the base thickness of the dam would have been 9 or 10 ft.; a thickness of 7½ ft. at the base was adopted, which involved rather high tensile stresses. The downstream face has a hollow profile to a thickness of 2 ft. at 30-ft. depth and thence a vertical profile to the top of the 60-ft. height.

Some curves of arch and cantilever stresses calculated for this structure by the combined-cantilever-and-arch

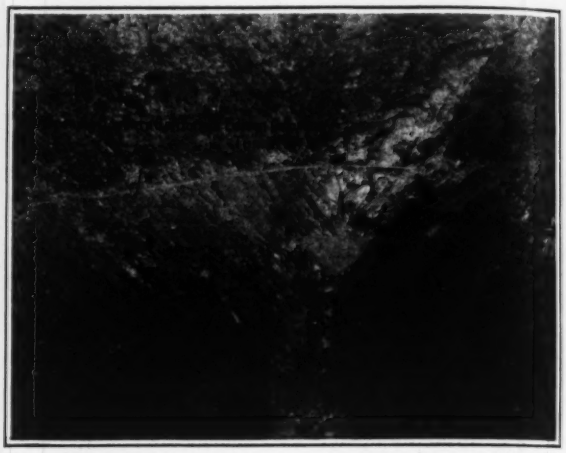


FIG. 1—SITE OF EXPERIMENTAL ARCH DAM, IN GORGE OF STEVENSON CREEK, SOUTHERN CALIFORNIA

theory are shown in Fig. 2. The modulus of elasticity of the concrete was assumed at 2,500,000 lb. per sq.in. for the arch, and 2,000,000 lb. per sq.in. for the vertical cantilever, the lower value taking account of the smaller stresses and the addition of shear deflection. Under the subdivision of load to which these stresses correspond, the arch and cantilever deflection lines are practically coincident.

The curves shown are for normal temperature. Temperature changes add further stresses. It is intended that the deflection and stress measurements shall cover all possible variables (depth of water, temperature change, shrinkage of concrete). As stated for the committee,

> the possibility of inclined arch action, the relative stiffness of the shorter cantilevers higher up on the side hills, and numerous other complications make an accurate determination of the stresses in an arch dam at our present state

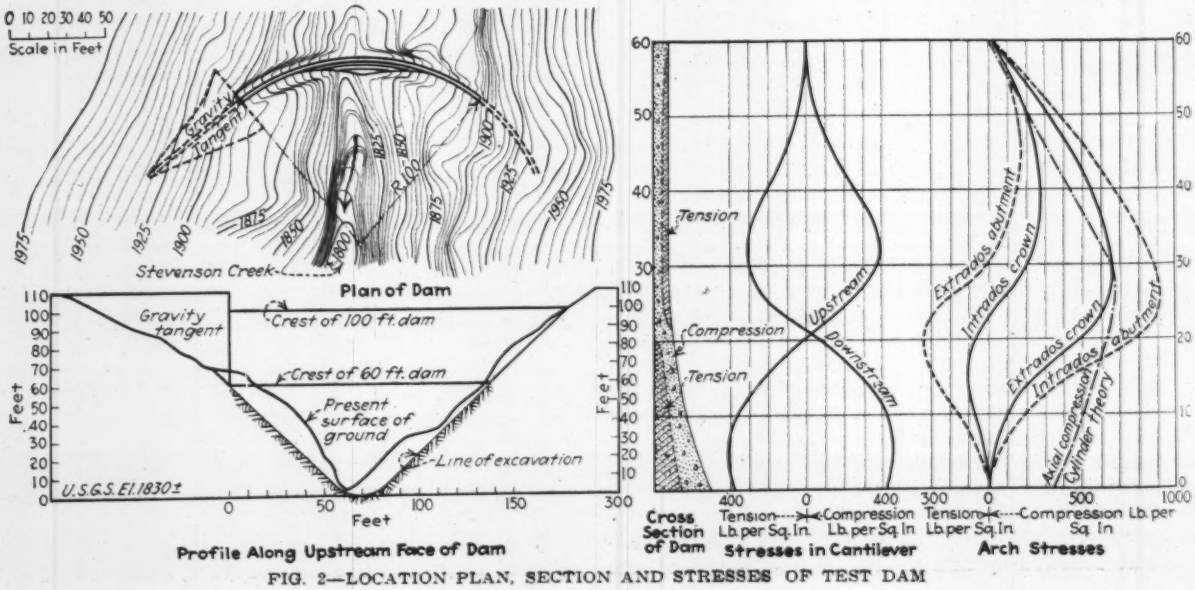


FIG. 2—LOCATION PLAN, SECTION AND STRESSES OF TEST DAM

of knowledge a problem of the first magnitude. It is therefore hoped that the experiments on the proposed test dam will furnish reliable data for making simplified assumptions upon which the design of future arch dams may be based.

The maximum tensile stresses in the cantilever are believed to be high enough that a crack will result near the base by the time the water is raised to the full 60-ft. height. It is intended that in the early stages of the experiments the water will not be raised so high, unless extensometer measurements show that the tensile stresses are smaller than theory indicates.

The committee is organized with Prof. C. Derleth, Jr., of the University of California as chairman, and F. A. Noetzli, of Los Angeles, as secretary. State Engineer W. F. McClure, of California, is a member. W. A. Brackenridge, senior vice-president of the Southern California Edison Co., Los Angeles, is trustee of the fund for the committee, and H. W. Dennis, of that company, is in charge of construction of the test dam.

Aside from the test-dam work, it is making observations on several existing dams, including Emigrant Creek, Clear Creek, Lake Eleanor, Lake Spaulding, Dam No. 6 of the Southern California Edison Co., and Gerber Dam of the U. S. Bureau of Reclamation. Properties of concrete and other factors of the problem also are being studied in the laboratory.

Drainage of Irrigated Lands May Be Charged to Maintenance

U. S. Supreme Court Establishes New Principle in Case of Idaho Irrigation District Against Boise Project

AN IMPORTANT precedent relating to irrigation costs is established by the Supreme Court of the United States in a decision delivered on April 13 in an Idaho case. The decision holds that the cost of drainage work may be properly charged as an item of operation and maintenance expense, and need not be considered a construction expense. The case is that of the Nampa & Meridian Irrigation District against J. B. Bond, project manager of the Boise project of the U. S. Reclamation Service and the Payette-Boise Water Users' Association Ltd. The case was appealed to the Supreme Court by the irrigation district from a decision of the Circuit Court of Appeals for the Ninth Circuit, which in turn had confirmed a District Court opinion. All decisions are against the irrigation district.

The facts of the case are summarized by Justice Sutherland of the Supreme Court as follows:

Appellant is an irrigation district organized as a public corporation under the laws of Idaho. In 1915, its supply of water being insufficient to irrigate the lands of all its members, it entered into a contract with the United States, at that time engaged in the construction of the Boise irrigation project, for water to irrigate the unsupplied lands and for the construction of a drainage system within the district. The district undertook to represent these lands in their relations to the government and collect from their owners and pay over to the government construction installments and operation and maintenance charges. The drainage system was constructed in accordance with the contract and the cost thereof, after deducting the amount chargeable to the old water right non-project lands within the district, was paid by the United States as a construction expense and, with other costs of construction, was charged ratably against all the project lands, being 40,000 acres within and 100,000 acres outside the district. After the construction cost, including this drainage, had been fixed by the government, it became necessary to drain project lands outside the district because they were being ruined for agricultural uses by the steadily rising ground level of seepage water due directly to the operation of the irrigation system. Thereupon, the Secretary of the Interior authorized the construction of a drainage system for these lands, the cost to be charged to operation and maintenance, and to be borne ratably by all the water users upon project lands both within and without the district. Appellant contended that this expenditure was not properly chargeable to operation and maintenance but was an additional charge for construction, which appellant could not be required to collect and pay over under paragraph 4 of the Reclamation Extension Act of Aug. 13, 1914, c. 247, 38 Stat. 686, 687, which provides that no increase in construction charges shall be made after the same have been fixed except by agreement between the Secretary of the Interior and a majority of th water right applicants and entrymen to be affected thereby. It was insisted further that appellant would be precluded by state law from collecting the charges from owners of non-project lands, because they were not benefited. The government having threatened that unless the charges were paid it would shut off the supply of water from the project lands within the district, appellant brought this suit to enjoin such action. The federal district court dismissed the bill, 283 Fed. Rep. 569; and its decree was affirmed by the circuit court of appeals, 288 Fed. Rep. 541. Both courts held that the cost was a proper charge as an operating expense and that the project lands in the district were liable for their proportionate part.

The contract with the district, among other things, provides: "The project lands in the district shall pay the same operation and maintenance charge per acre as announced by the Secretary of the Interior for similar lands of the Boise Project . . ." We agree with the courts below that the charge in question fairly comes within this provision.

Essential parts of the reasoning, on which the Supreme Court bases this decision, are indicated in the following extracts:

Expenditures necessary to construct an irrigation system and put it in condition to furnish and properly to distribute a supply of water are chargeable to construction; but when the irrigation system is completed, expenditures made to maintain it as an efficient going concern and to operate it effectively to the end for which it was designed, are, at least generally, maintenance and operating expenses. The expenditure in question . . . was for the purpose of overcoming injurious consequences arising from the normal and ordinary operation of the completed plant. . . . The fact that the need of drainage for the district lands, already existing or foreseen, had been supplied and the cost thereof charged to all the water users as a part of the original construction, by no means compels the conclusion that an expenditure of the same character, the necessity for which subsequently developed as an incident of operation, is not a proper operating charge. . . .

. . . It is not necessary that each expenditure for maintenance or operation considered by itself shall directly benefit every water user in order that he may be called upon to pay his proportionate part of the cost. If the expenditure of today does not especially benefit him, that of yesterday has done so or that of tomorrow will do so. The irrigation system is a unit.

Water Powers of Great Salt Lake Basin

The total capacity of undeveloped power sites in the Great Salt Lake Basin is 81,000 hp. for 50 per cent of the time and 56,000 hp. for 90 per cent of the time without regulation, and 115,000 hp. and 80,000 hp. respectively, with regulation, according to water supply paper 517 of the U. S. Geological Survey. Four sites on Diamond Fork of Spanish Fork would yield 11,700 hp. and 8,900 hp. for 50 and 90 per cent of the time; three on Logan River would yield 19,300 hp. and 11,400 hp.; four on Weber River would yield 11,600 hp. and 9,150 hp. for 50 and 90 per cent of the time, with unregulated flow. On the Bear River, with regulated flow, four sites would yield 30,000 and 21,000 hp.

Deep Foundations Replace Piles Tilting to River

Cribbing Frees Old Footings—Dock Wall Anchored —New Concrete Footings Surmount Piers Sunk to 100 Ft. Below Water

UNDERPINNING an old eight-story river-front Chicago building whose columns and pile foundations were tilting towards the river was a job which required great care in handling, but which has been accomplished successfully, the columns being restored to position and placed on concrete piers sunk to rock. All this work was done while the building was occupied.

The Mallers Building, on the east bank of the Chicago River between Quincy and Jackson Sts., is an eight-story structure about 208 x 228 ft. in plan, of mill-type construction, with cast-iron columns, wooden floor framing and brick walls. It is occupied mainly by clothing manufacturers. Along the river side of the first floor is a driveway, the wall being set back to the second row of columns. The building has eight bays and is divided into three sections by brick firewalls, which are carried by double columns (Fig. 1); the load on the footings is 250 tons for each single column and 500 tons for each double column.

Noticeable displacement of the columns in the west side of the first story led to an examination which disclosed defective masonry and piling in the foundations under these columns. The tilting of the masonry footings, with their bases moved outward toward the river, is shown in Fig. 1. Originally the center lines of these columns were 6 ft. from the dock line, but the bases were found to have moved approximately 7 in. toward the river, while the footings of stone masonry had tipped to such an extent that many of the lugs for bolting the columns to the shoes had been snapped off. This movement increased 2 in. during the early stages of the underpinning, and Fig. 2 shows the displacement.

FIG. 1—COLUMN WITH BASE PUSHED OUT 9 IN.
White mark indicates plumb line.

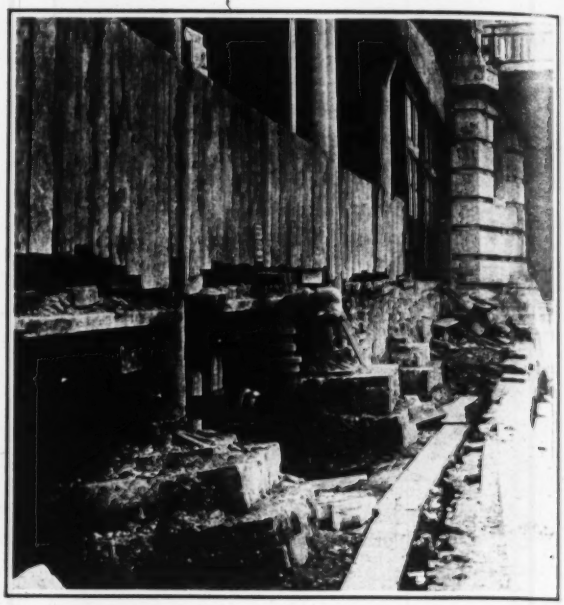


FIG. 2—MASONRY FOOTINGS TILTING OUT TO RIVER

Along the dock wall of pile and timber construction there was about 18 ft. of water or a depth of 24 ft. from top of wall to the river bed, and, as the entire dock was leaning outward, it was apparent that great precautions must be taken to prevent the collapse of the wall. Thus no load could be placed upon it for the shoring of the building. The wall had been tied back to timbers bearing against the foundation piles under the second row of columns, but these timbers had rotted and as the river level has been low for some years the heads of the foundation piles were exposed and had begun to decay.

Reconstruction methods are shown in Fig. 3. The first step was to tie the dock in place by means of long ½-in. rods put through a new waling timber and carried back to anchorages consisting of pairs of long channels laid across the rear side of the masonry footings of the fourth and fifth rows of columns. This was done in ten days, during which period the footings of the first row of columns moved outward more than an inch, so that the columns were nearly 9 in. out of plumb.

Since it was not considered advisable to apply any vertical load or lateral thrust on the dock piles, cribbing was built in holes excavated between and on the east side of the columns for the full width between the old stone pile caps or footings and to such depth as to obtain a 1 on 1 slope to the river bed. Each crib was topped with steel screw jacks and cap timbers. Heavy I-beams, parallel with the dock, were then laid from crib to crib, on the cap timbers, part of the stone foot-

ings being broken off to allow these beams to be placed as close as possible to the east or land side of the columns. At each column these beams formed the fulcrum bearing for a set of four cantilever beams whose forward ends projected beyond the wall column while the uplift at the rear end was resisted by cross-beams bearing against a steel pin put through the next column in the rear, as shown.

By placing the fulcrum beams as close as possible to the wall column the size of beams for the cantilevers was reduced, so that they could be placed under the

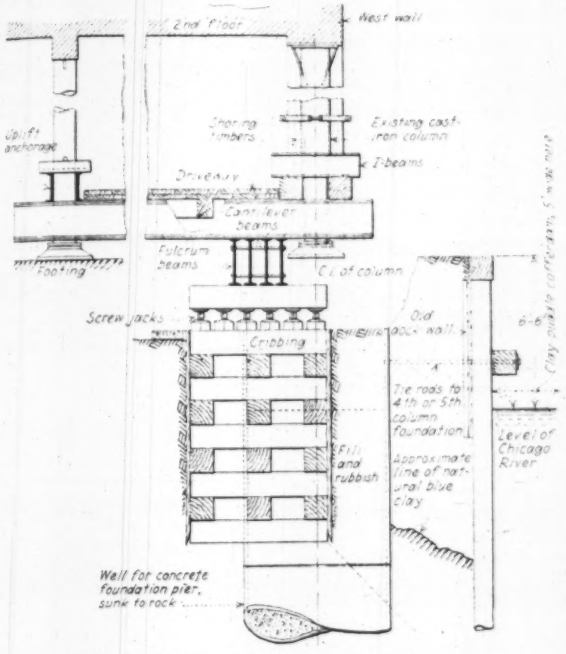


FIG. 3—UNDERPINNING COLUMNS FOR NEW FOUNDATIONS

river front driveway, as it was essential to avoid interrupting the use of this driveway for wagon service to the building. On the cantilever ends of the two beams at each column were seated six vertical 12 x 12-in. timbers, the heads of which were wedged up against the column head and the girder above so as to take the load from the column.

With the footings thus released from load and the dock wall firmly anchored, the next step was to build a cofferdam of piles and wood sheathing outside the dock wall, clay puddle being filled between this sheathing and the old dock. After the old footing had been removed, foundation wells or caissons 6 ft. in diameter were sunk under the columns, extending to solid rock at about 100 ft. below the water level in the river. These wells were concreted to a little above the water line and each was surmounted with a rectangular concrete footing. The column base was anchored to this footing in proper position and the column then jacked back to its seat on the base, which was then embedded in concrete. A footing for the wall carrying the driveway was built between the column footings and after removal of the cofferdam the old pile and timber dock wall was repaired.

Level readings throughout the building were taken twice daily, but owing to the special care taken in digging the foundation wells the maximum settlement at the second row of columns from the river wall was only ¼ in.

This underpinning and new foundation work was done by the L. P. Friestedt Co., Chicago, with S. M. Gooder as its superintendent of construction. It was commenced in December, 1923, and completed in May, 1924.

Rail-Motor Cars, Buses and Branch Lines: Boston & Maine R.R.

ACTUAL and proposed abandonment of branch lines aggregating 180 miles is noted in the annual report of the Boston & Maine R.R., which states that while much of the unprofitable mileage is due to the fact that the system is a combination of many competitive small roads constructed years ago, the situation has been brought to a head by the extensive highway program and the rapid development of the motor bus and motor truck. In the belief that in many cases the rail transportation can be economically replaced by motor vehicles on the highways, the Boston & Maine Transportation Co. has been incorporated to undertake such motor service where rail lines are discontinued. This company's first application, made in March, 1925, was to the New Hampshire Public Service Commission for motor car service at Portsmouth, N. H., to replace that of the Portsmouth Electric Ry., which for many years has been operated at a loss by the Boston & Maine R.R. As to the above subject and introduction of motor-cars on branch lines the report has the following statement:

Motor Cars on Branch Lines—Early in 1924, the purchase was authorized of two types of gasoline rail motor cars. The single unit car was operated for a time on the Ashburnham Branch, and since September, 1924, has been in operation between Manchester and Ayer. The heavier type of car with trailer, only recently received, will be operated in main line service between North Adams and Troy. It is believed that a certain number of these units can be used on lines which must be retained for freight service, and where the volume of passenger traffic is sufficient to justify the expense. But where freight traffic does not justify the maintenance of the track, passenger traffic can be most economically handled by the highway bus. This conclusion has been confirmed by results on the Ashburnham Branch, on which both steam and gasoline rail-cars were used experimentally. In September, 1924, a highway bus was substituted for the rail motor car, and has been operated through the winter at substantially less expense.

Motor Truck and Bus Situation — All common carrier vehicles, freight and passenger, should be subject to the same regulation (interstate or intrastate) as steam and electric railroads, and a uniform system of taxation should be enacted for all public utilities. Existing conditions clearly discriminate against the steam and electric lines and favor the highway transportation companies. The interurban competition of the common carrier passenger buses along the main line routes of the Boston & Maine R.R. became so keen in 1924, particularly in Massachusetts where these vehicles are not subject to regulation or restriction, that it seemed necessary for the railroad to present its case to the various cities and towns where bus companies were applying for licenses to compete with the railroad for its single trip passenger business. Some cities and towns have declined to issue licenses to independent bus lines, recognizing that they were taking from the railroad the more profitable standard fare traffic, and that if deprived of this traffic, the railroad could not afford to continue low rate service for commuters.

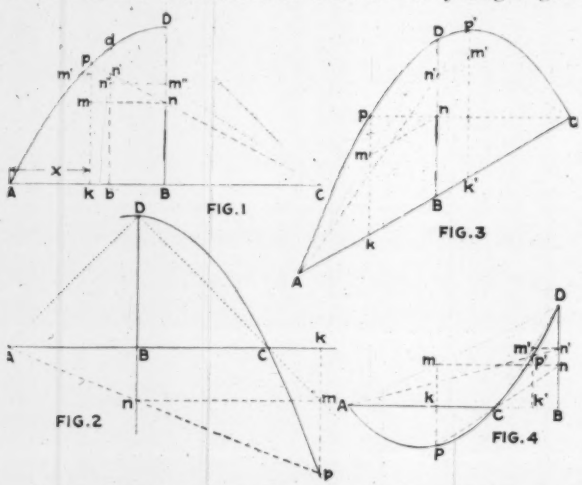
From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Constructing Parabolas By Points

BY H. E. WARRINGTON
San Francisco, Calif.

MANY years ago the method of constructing a parabola by points, shown in Fig. 1 herewith, was published in *Engineering News*, by whom I do not now recollect. It apparently has been forgotten, in spite of its merit, for I have found none of the younger generation of engineers familiar with it, nor have I seen it mentioned in any of the structural textbooks. One of its considerable advantages is that quite frequently only a single point of the curve is needed, which this method gives at once. It occurs to me that its republication would be of interest and advantage. Briefly, the method is as follows:



FOUR METHODS OF CONSTRUCTING A PARABOLA

To construct a parabola on the base *AC*, given the middle ordinate *BD*. Draw the lines *AD* and *CD*. To find a point on the curve with abscissa *x*, such as *k*, draw *km* vertically: where it intersects *AD* at *m*, draw a horizontal line to an intersection *n* with the ordinate *BD*. Through *C* and *n* draw *Cn*, extending it until it intersects *km* extended at *p*; *p* is the point required.

This was the construction as given. Fig. 2 shows an extension to points beyond *A* or *C* on the base, as at *k*. The construction is precisely similar to that of Fig. 1, *DC* and *DB* now being extended downward. The lettering corresponds to that of Fig. 1. Occasionally this construction is of use in the case of continuous beams though in general a straight line joining *C* and *p* is sufficiently accurate.

The parabola as above described has its axis perpendicular to the base *AC*. It is not necessary that *BD* be the middle ordinate to the curve, though usually that is the one given. Any ordinate such as *bd* may be employed, the construction being the same as above, the lines *AD* and *CD* now becoming *Ad* and *Cd*, and the *n* points being on the ordinate *bd*. (See Fig. 1.)

As a matter of some interest, the same construction applies also to oblique co-ordinates, as shown on Fig. 3. In this case, the lines of type *mn* must be drawn parallel to *AC*, as indicated. Of course points on the curve beyond *A* or *C* can be found exactly as shown in Fig. 2, the *mn* lines being kept parallel to the base. This parabola, of course, has its axis parallel to the ordinates of the type *BD*, and the construction is of value for interior girders of continuous spans.

As shown by Fig. 4, the same construction may be readily extended to the drawing of the curve through any three points *ACD* (of course not in the same straight line) the direction of the axis also being given. In the figure the axis is parallel to the line *BD*. The other cases are in fact special cases of this general one.

There are a number of other properties of the construction, but these are of more interest to the mathematician than to the engineer.

Sinking, Cleaning and Testing Wells on the Los Angeles Aqueduct

BY GEORGE R. SHUEY
Assistant Engineer, Department Public Service, Los Angeles, Calif.

THE Department of Public Service of the city of Los Angeles is developing an auxiliary water supply for its aqueduct during the present dry cycle, by drilling wells into the gravel beds in the lower part of Owens Valley. Seventy-five wells had been drilled to Feb. 10. The tested production totals 90 sec.-ft., nearly one-fourth the carrying capacity of the aqueduct.

The method of developing a well after drilling is as follows: Into the 16-in. well is placed a line of light 12-in. casing, with slip joints, 23 ft. long. At the bottom of the lower joint is a heavy shoe. A flat hook, with cable attached and handled by a drum on the rig, engages the shoe, and carries the weight of the casing. The cable is outside the 12-in. casing. This string of casing is let down to a point above the bottom of the well equal to the length of the pump to be installed, usually 115 ft.

TESTING A WELL SUPPLEMENTING THE LOS ANGELES AQUEDUCT SUPPLY

The pump discharge shown is at the rate of 4½ sec.-ft. The well rig is shown in the background.

"Engineering News-Record" as an Aid to Technical Instruction

By Harry Tucker
Professor of Highway Engineering,
North Carolina State College, Raleigh, N. C.

WHILE there are a number of good text books on highway engineering, developments in this field are so rapid, research so extensive, and new methods so constantly being initiated, that recourse to current literature must be had to supplement text book and lecture instruction. To this end I have made out a list of subjects pertaining to highway engineering on 3x5-in. cards, and from time to time the articles appearing in *Engineering News-Record* dealing with these subjects are entered on the cards. As a rule, I find it only necessary to give the subject of the article, with volume and page references. Instead of attempting to post the cards each week, I usually wait until several issues have accumulated, and then, choosing a leisure period, read the articles carefully, and post the cards, at the same time making such notes as are necessary.

Such a list of references can be used in three ways. First, as the special subjects in highway engineering are being studied, the students can be given the card index reference to the articles for parallel reading. It is usually well to require each student to hand in a synopsis—in a few words—of the main points in each article assigned, unless the articles are to be discussed in class.

To illustrate: One of my card index subjects is "sub-grade," under which I have some fifteen references to articles in *Engineering News-Record*. In studying this subject recently, the students were enabled to get the results of the latest researches that are being conducted in this field through requiring them to read several of these articles.

A second use to be made of such a list of references is to aid students in preparing themes or theses for other departments. Very frequently engineering students are required to write such papers about some engineering subject. By allowing them to consult the card index, they can find both a list of subjects and numerous references to articles covering each subject. This is not only a great help and convenience to the student but greatly conserves the time of the teacher.

A third use which I make of this reference file is in preparing papers or talks—something that all teachers of engineering are called upon to do. My file includes such general subjects as "Engineering Ethics," "Engineering Education," "Engineers' Economic Position," etc. In preparing a talk on engineering ethics recently I found some forty references to articles in *Engineering News-Record* listed under this one subject and after reading a few of them over carefully I found no difficulty in quickly preparing a fifteen-minute talk.

The question may now be asked, why not make use of the index of each volume of the *Engineering News-Record*, instead of going to the trouble of preparing such a file? The answer is obvious: the index does not always have the articles listed under the specific subject desired; and, furthermore, its use necessitates more time in searching the indexes, and examining the articles, just when there is the least time available. The preparation of such a file as I have described is not laborious; only about two hours per month are required to keep it posted to date.

The foregoing suggestions are made with particular reference to the use of such a file in teaching; but why should it not be of great service to all engineers? There is a tendency among engineers to glance through their technical magazines and then throw them aside. If they were saved, a card index reference to suitable subjects prepared, and then each volume bound, the engineer would have one of the most important additions to his library.

The method which I have described here is of course not new; but has always been in use by the most successful teachers. My object in outlining its advantages is to indicate how teachers of technical subjects and particularly the younger teachers, may use such a reference file to increase their own efficiency and at the same time inculcate in the student a wholesome knowledge of the use of technical magazines.

A screw pump, belt-driven by a 120-hp. engine, is placed in the well, inside the string of casing. The pump capacity at full speed is 5 sec.-ft. After operating the pump at full speed for a few hours the lower part of the well fills with sand up to the bottom of the casing, thus cutting off the lower part of the well, and the water is drawn from the upper strata. Pumping is continued until no sand or cloudy water shows in the discharge. Starting and stopping the pump gives a surging effect, which seems to wash the sand into the well and out through the pump.

When the water from the upper strata is clear the suction is lowered by releasing the drum, the pump being operated continuously during the lowering operation. Every 5-ft. drop in the suction results in a large amount of sand and silt appearing in the discharge, from the deposit in the well itself, and the lower strata that are opened up. This operation is continued until the casing reaches bottom. The well is now free of sand, and all fine material washed out of the perforated strata, leaving a screen of coarse gravel behind. It takes from 60 to 75 hours continuous run to clean the well completely.

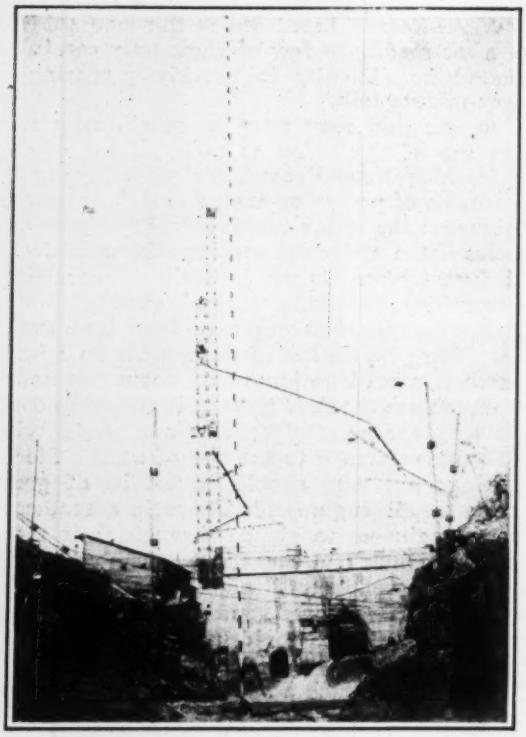
A curve of the well is then made by measuring the discharge and drawdown at varying pump speeds, up to the maximum capacity of the pump, or of the well,

and plotting each in terms of pump revolutions per minute. From these curves the proper size of pumping layout can be designed, with the certain knowledge that it will fit the well—a tailor-made plant.

Seven well rigs are now in service, owned and operated by the Department of Public Service. Work is directed by William Mulholland, chief engineer of the department. The field work is in charge of the writer.

Pipe Backsight 120 Ft. High Set at Dam Curve Center

IN THE construction of the Exchequer dam, which is an arched structure, the center of the curve on which the dam is laid out happened to be at a point visible



GENERAL VIEW OF DAM WITH BACKSIGHT IN FOREGROUND

from all parts of the work. It was therefore decided that it would be a convenience to have a marker at this center which would be available continually for backsights and which might even be used for lining in with the eye when the accuracy of instruments was not necessary.

Accordingly, a pipe marker 120 ft. high was erected at this point, and guyed in position as shown in the accompanying illustration. To improve visibility it was painted black and white in alternate bands one foot high. The support at the base consists of a 1¾-in. iron bar firmly fastened in the rock over which was fitted a 2-in. pipe. The diameter reduced to 1½ in. some distance above and in the topmost section to 1 in. Four sets of guys, six to each set, were used to true up the marker and there has been no slipping or variation from the true vertical position.

Engineering on this job is under the direction of R. V. Meikle, chief engineer, and Daniel McFarland, assistant engineer, Merced Irrigation District.

From Job and Office

Hints that Cut Cost and Time

Protecting Steep Banks by Planting Live Willow Poles

MODIFICATION of the old method of protecting shores from erosion by planting trees on the slopes has been devised in Canada and has been used in this country and in Canada with considerable success. The new system is an improvement on the old in that instead of planting cuttings in the slopes, large poles of live willows with their butts buried at the toe of the slope are laid up the slope in shallow trenches and allowed to take root. It has been found that a quicker and stronger growth is obtained by this means as the poles are able to obtain moisture from around their butts and so are independent of the amount of moisture in the face of the bank. The poles take root all the way up the slope and send up sturdy shoots for their entire length.

In detail, the method consists in grading the bank needing protection to a uniform slope and then burying poles of live white willow, *salix alba*, up this slope in shallow trenches. The butts of the poles are buried at the toe of the slope where they will be moist and are anchored to wooden or iron fence posts driven into the ground at the toe of slope, and to poles of live

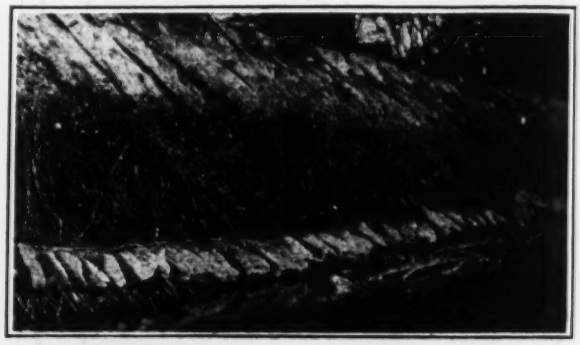


FIG. 1—ANGULAR TREE PLANTING FOR BANK PROTECTION

Above, bank protection on Gatineau River, Canada. Below, shore protection at Port Stanley on Lake Erie. Sand trap being built to add to the material at the toe of slope.

willow set well back of the top of the bank. The poles are spaced about 5 ft. apart. The lower edge of the slope is then protected by a stone mattress made by filling a net of wire fencing with stones and securing it to the anchor posts. Above this, brush is laid between

From Job and Office

For Contractor and Engineer

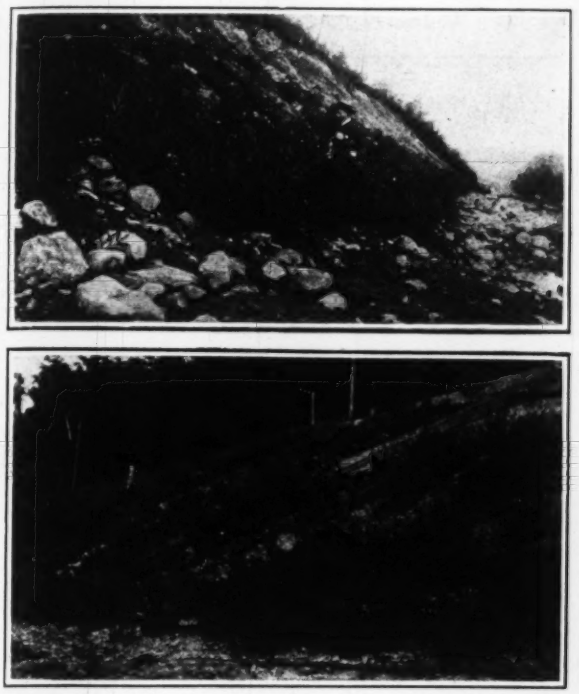


FIG. 2—ONE YEAR'S GROWTH ON RAILROAD EMBANKMENT

the poles and held in place by wire fencing laid over it and fastened to the poles.

Two methods of application are shown in Fig. 1. Sand traps are used where it is desirable to add to the toe of the slope.

The method is applicable to the protection of railroad embankments even where there is no water at the toe of the slope, but where the earth in the ditches is wet. Fig. 2 shows the results obtained on the Canadian Pacific one year after planting.

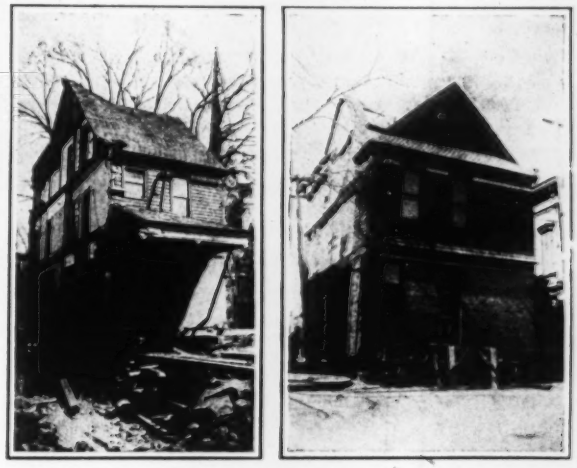
A very good example of what has been accomplished is shown in the work done by the New York State Forestry Association at Camp Hawley on Kinderhook Lake, where erosion had converted a gentle slope into a steep bank. Fig. 3 shows the condition of the bank when the work of grading it and planting the trees was started and the same bank the following season.

This method of bank protection, known as the angular submerged tree planting, has been patented in the United States and Canada by O. S. Scheifele of Conestogo, Ont., Canada.

House Cut in Half, Moved and Rebuilt on New Foundations

By J. J. Birch
Schenectady, N. Y.

A THREE-STORY house of brick and wood construction estimated to weigh 450 tons was recently moved a distance of three blocks and made to turn three



HOUSE CUT IN TWO AND MOVED THREE BLOCKS
One section leaving old foundation shown at left. Second section being rolled through narrow street.

corners, in Schenectady, N. Y. The house was located in one of the older sections of the city where streets were exceptionally narrow, so it was first necessary to cut the house in two sections and move one at a time.

Two 12x12-in. beams were placed at right angles to

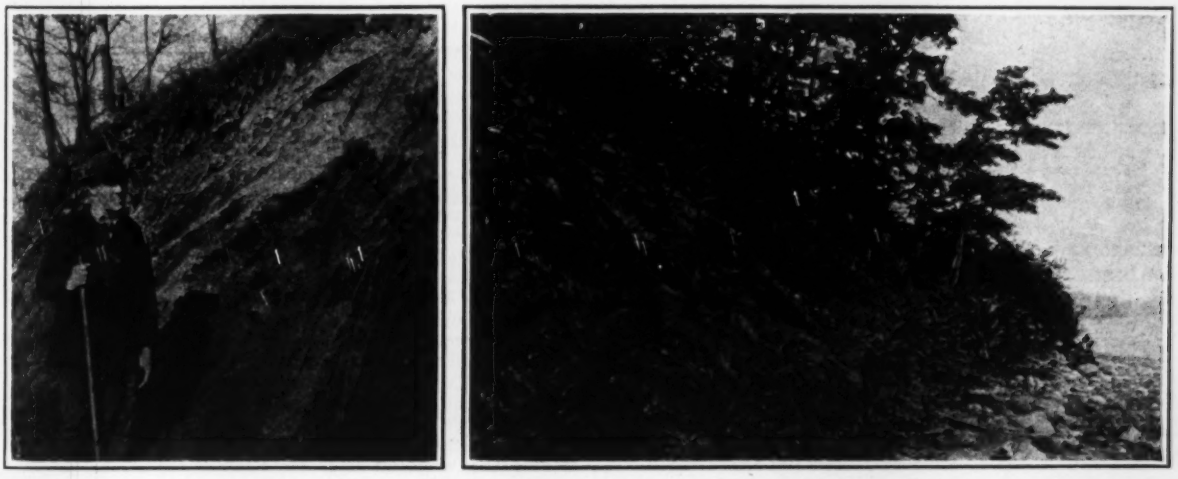


FIG. 3—BANK AT KINDERHOOK LAKE BEFORE AND AFTER PLANTING

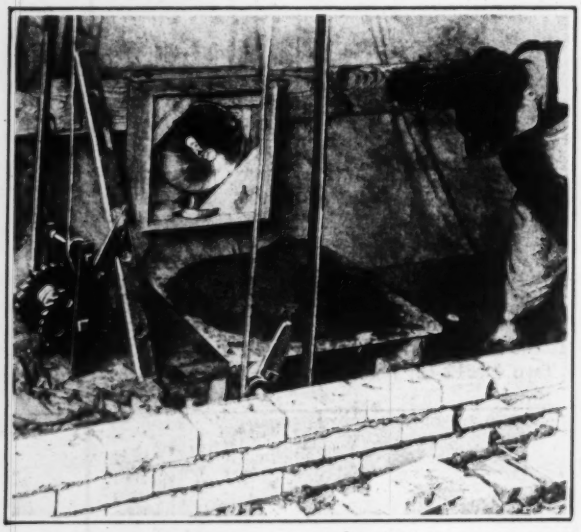
the floor timbers and each section was separately slid to the street by means of rollers. A steel cable was fastened in the form of a loop around the ends of each timber and then by means of a block and tackle and windlass was moved along the streets. The windlass was held in place by driving four pointed steel rods (the rear axles of automobiles) through the asphalt pavement and concrete sub-base. These were driven slightly slanting and formed a very secure and satisfactory anchorage not only for the windlass but the tackle block as well.

When the building arrived at its destination an incline was built and each section slid to its new foundation and then lowered upon the wall. In the moving very little damage was done either to the plastering, brick walls or plumbing.

Electric Heat Aids Contractor in Laying Cold Weather Masonry

IN THE construction of the Park apartments being erected in Buffalo, N. Y., the contractor was confronted with the necessity of providing heat both for mortar and for the men laying the wall. Because of the cold, salamanders were found inefficient, the workmen often leaving their jobs to warm their hands and feet. Already pressed to meet a completion date, the contractor saw that he would have to resort to some other method with no loss of time.

He, therefore, installed a battery of 36 Westinghouse Cozy Glows, these appliances consisting of a heating

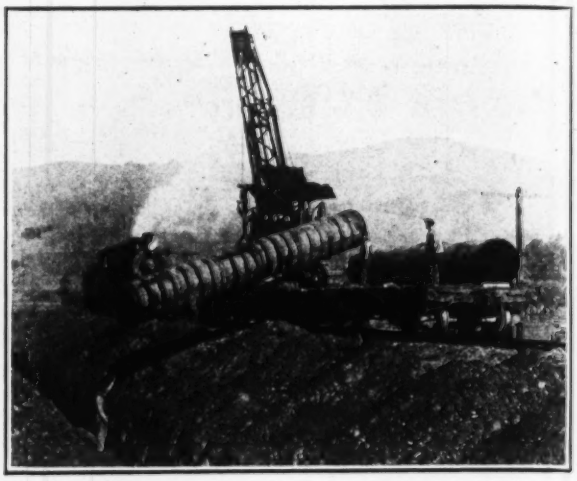


REFLECTOR MOUNTED ON SCAFFOLD GUARD RAIL
Work is being carried on six floors above the street level. Position of the heating unit shows the possibility of keeping both materials and workmen warm through direct rays.

element and a bowl-shaped reflector for throwing out the heat. The reflectors were so placed that the heat was thrown directly upon the work at all times preventing both freezing of materials and the workman from getting too cold. The units were placed in wooden boxes so they could be moved from place to place without trouble, and also to prevent their being damaged. A hanger was put on the back of each box, and as the work progressed the bricklayer took the outfit along and hung it on the guard board of the scaffold.

Tractor Delivers Pipe Sections from Train to Trench

IN PLANNING the pipe line on the east side of the San Francisco Bay crossing that is to convey first Calaveras and later Hetch Hetchy water into the San Francisco-Peninsula reservoirs the line was located



TRACTOR HANDLING PIPE FROM FLATCAR

along the Western Pacific R.R. right-of-way. This railroad location followed the route desired, simplified right-of-way problems and made it possible to use a convenient and inexpensive method of construction—delivering pipe along the trench without rehandling.

The pipe was shipped in trainloads of 20 to 25 cars and a crawler tractor crane of 8 tons capacity with a 35-ft. boom was placed on a flatcar at one end of the train. The crane unloaded the pipe, placing it in any desired location alongside the trench. After unloading one car of pipe the crane would move forward over the top of the unloaded flatcar and was then in position to unload the next car, and so on. With this method 80 sections of pipe, approximately 30 ft. long, weighing 2 tons per section, were unloaded in 8 hours with a crew of 8 men.

The pipe is being supplied by the Western Pipe & Steel Co., which has a contract with the Spring Valley Water Co. for furnishing and installing on this job approximately 15,413 ft. of 44-in. diameter, ¼-in. riveted steel pipe.

Job and Office Notes

About Two and a Half Years Ago concrete piles at berths 57 to 60 in Los Angeles harbor were painted with a gasoline-asphaltum paint which was also put on the underside of the wharf substructure at these berths. This application has been carefully watched and is now in as good a condition as it was immediately after it was put on. The conclusions are so favorable that all concrete piling and substructure work in the harbor is now being treated in a similar manner under the direction of the harbor engineer. The material used is mixed in the following proportions: 240 lb. asphaltum, 3 gal. lubricating oil, 30 gal. gasoline. These quantities make about 50 gal. of paint which is sufficient to cover 200 to 250 sq. ft. It is put on cold and can be applied either with hand brush or spray gun. The cost of this paint is about 40 to 45c. per gal. When necessary it is thinned out with gasoline to facilitate application.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Engineering By Questionnaire

Sir—As a profession we owe the duty to the public of doing everything possible to insure a maximum return in highway transportation service for every dollar of the huge sum being expended in highway construction. Such a maximum return can be secured only if highway expenditures are supervised by men who are experts in highway construction and who know how to design roads suited to the service they are destined to perform. Neither an underdesign nor an overdesign is economical.

The writer has just received evidence of what he considers to be serious waste in the expenditure of highway funds, and for this the engineering profession is partly to blame. The evidence is a questionnaire from the highway commission of a middle western county. The questionnaire lists nine possible asphalt pavement combinations, ranging from penetration macadam to sheet asphalt, and asks for the first, second, and third choice of the recipient. All pavements are to be laid on a 5-in. concrete foundation.

Can anything show a greater lack of appreciation of the fact that pavement selection is an engineering problem depending for its solution on many factors not here mentioned? Would the same commission present a questionnaire to various learned physicians asking for their first, second or third choice of medicines to be used to relieve a pain in the back, or would they employ a questionnaire method at all in such a case? Of course not! They then attempt to solve an engineering question equally technical by the questionnaire method. That the commission has little conception of the technical nature of their problem is revealed when they consider placing a penetration macadam on a concrete foundation. That there are other engineering considerations of traffic classification, character of subgrade, use of local materials, effect on traffic operation, cost, grades and alignment, would obviously receive scant consideration, not to speak of the probable faulty construction of whatever type was selected.

Of course, few really competent highway engineers would reply to such a questionnaire for they would immediately see its futility, but such questionnaires must receive some answers, otherwise they would not be used. To just such a degree are those engineers who reply, unfaithful to the confidence the public places in them, as well as unfaithful to their fellow engineers. The engineering profession receives the blame when roads selected in such a manner fail, as they are bound to do. Our public servants must be brought to a realization that highway construction is extremely technical. The people will receive the worth of their money only if this is accomplished.

There can only be one answer to such a questionnaire—"Secure a competent engineer and leave the matter in his hands."

L. W. McINTYRE,
Assistant Professor of Civil Engineering,
University of Pittsburgh.

Pittsburgh, Pa.,
April 27, 1925.

Conservative Steel Specifications

Sir—The views of Edward Godfrey, as expressed in his letter in *Engineering News-Record*, April 9, p. 615, show that the writer has not familiarized himself with the activities of this "association of steel fabricators." I do not wish to refer to his remarks in connection with "Impact and Structural Safety" for they seem sound and are based upon his thorough study of and experience in the structural game. But there are remarks concerning this "association" which are incorrect, misleading and unfair.

Listen to this: "Naturally the steel interests want to get the jobs and the simplest way to that seems to be to raise the steel unit from 16,000 to 18,000 or 20,000 lb. and the chief argument is the absence of failures recorded on the 16,000 basis." First, let me quote from one of the pamphlets of this association: "The American Institute of Steel Construction have undertaken the work of promoting uniform practice in the industry, and in order that their efforts would not be interpreted as being unduly influenced by commercial interests, they have selected a committee from among the leading talent in the academic, engineering and architectural professions to prepare a Standard Specification on the Design, Fabrication and Erection of Structural Steel. This committee represents a combined experience of approximately one hundred and fifty years in an industry which is not more than thirty-five years old. The personnel is as follows: George F. Swain, Milo S. Ketchum, E. R. Graham, W. J. Thomas and Wilbur J. Watson."

Second, has it occurred to Mr. Godfrey that the general adoption of the 18,000 basis will mean the use of less steel instead of more? Raising the unit stress means less steel required. There might be a few cases where this decrease would be sufficient to throw the cost in favor of steel in preference to other types of construction but these cases would be few and far between.

Third, this "association" does not recommend 20,000 as stated in his letter. On the contrary they hesitate making such a recommendation. However, I understand that a committee from one of our most conservative of associations, the American Society of Civil Engineers, has handed in a recommendation that the unit stress be raised above that specified by this "association," even to 20,000.

Fourth, the "chief argument" is not "the absence of failures recorded on the 16,000 basis" but the fact that this 16,000 unit was adopted many years ago and that the quality of steel produced and the quality of fabrication and inspection prevailing are sufficiently improved to warrant this increase in the allowable unit stress.

Further, Mr. Godfrey might be interested to note that this "recent yielding of some authorities" has really become "alarming." Nearly every large city in the Union has either incorporated the specifications of the American Institute of Steel Construction into building codes or has issued an approval of its use. And if I am correctly informed he will find that many of our leading engineering universities are now using these specifications in their classes.

PAUL B. COVEY,
Structural Engineer, New Hampshire
Structural Steel Co.

Manchester, N. H.,
April 24, 1925.

In Defense of Educational Methods

Sir—The letter of R. Z. Kirkpatrick, published in your issue of April 23, p. 701, reflects some common misconceptions of engineering and engineering training. Something should be said at this time to show that there is at least a minority that ascribes the shortcomings of engineers, both young and old, to other causes than the want of practical instruction in our engineering colleges.

Engineering is applied science. The man with the best command of science, other things being equal, is the best engineer. The engineer is not a compendium of facts. He is a scientific thinker. He is able to think clearly because he has a command of fundamentals, which when combined, lead him to conclusions that are safe and reliable. The engineer is trained, not by learning how to do things. He discovers why effect follows cause.

The young men to whom Mr. Kirkpatrick refers have doubtless come from schools which attempt to cram facts into students. This is a hopeless undertaking. The easiest way to teach is to advertise, to entertain students in the class room and to give them a few facts as a sedative. This kind of instruction is too common in our engineering schools. Students can not always discriminate between the teacher who encourages them to think and the teacher who deals in facts and propaganda. Engineering schools must assume responsibility for quality of instruction. The field of engineering is too broad to expect any one person to carry about with him the information needed on every occasion. The young engineer who knows his science will not only return the right answers to such questions as Mr. Kirkpatrick propounds, but he will grow as experience broadens his horizon.

We should not expect a young engineer to furnish facts off-hand or to give an immediate reply to a technical question. The young man who is properly trained will not ven-

ture a reply until he has been able to apply scientific analysis to the problem in hand. Young men go to college to train their minds, not to absorb facts to be delivered to employers on demand.

No greater mistake is made by those not in contact with the teaching of engineering students than to assume that only practical engineers can give the best instruction. Our engineering schools are suffering more from that theory today than from any other one cause. The teacher is necessarily an unusual man. He must go over the same ground each year, improving his methods, keeping up with new discoveries and adding his contribution to the sum of human knowledge in the field which interests him. An engineer in practice can not spend the time necessary to equip himself as a teacher. He may become an effective teacher with the lapse of years. When he begins he is likely to entertain students for a year or so. He gives them a few facts, or something that he calls facts. After he has taught, or after he has gone through the motions of teaching, for a term of five or ten years, he begins to discover that students must think if they are to grow intellectually. When he tries to stimulate thinking, he discovers that teaching is a man's job.

If engineers in practice hope to raise engineering to a profession, they must have more respect for science, the only foundation on which they can build. As far as the engineer is concerned, nothing but science is practical. If he learns this during his period of university training, he will not disappoint employers and he will not seriously discredit the school from which he comes.

Ann Arbor, Mich., April 29, 1925.

CLARENCE T. JOHNSTON, Professor of Geodesy and Surveying, University of Michigan.

Effect of Deforestation on Runoff in Mississippi Basin and Flood Prevention

Sir—Colonel Potter's deductions as to the runoff of the upper Mississippi watershed under varying conditions of forest growth, in his article on "Some suggestive ways of controlling the Mississippi floods" in your issue of April 2, p. 556, are interesting but they do not seem to me to be well supported by analysis of the facts. All the data on which Colonel Potter based his conclusions are not at hand; however, I have examined the precipitation records as published by the Weather Bureau. The records are available for Pokegama Falls, Leach Lake Dam and Lake Winnibigoshish for complete years from 1888 to 1923. They cover only four years of the first seven-year period, 1885-1891, selected by Colonel Potter for his comparison. The average annual precipitation for the state of Minnesota is published beginning with the year 1886 and hence covers but six years of this first seven-year period. The following table gives information bearing on the amount of rainfall in the periods chosen by Colonel Potter:

Period	Average rainfall at Pokegama Falls, Leach Lake Dam, and Lake Winnibigoshish in per cent of 36-year average (25.8 in.)	Average rainfall in State of Minnesota in per cent of 38-year average (26.0 in.)	General conditions of precipitation in upper Mississippi watershed	Percentage of runoff per Colonel Potter
1885-91	96(a)	92(b)	Apparently lower than normal	20.2
1891-98	103	99	Above normal	22.7
1899-1905	113	115	Abnormally high	34.2
1906-1912	95	99	Somewhat below normal	23.7
1913-1923	94	97	Lower than normal	23.1
1917-1923	85	90	Abnormally low	19.0

(a) Covers only 1888-1891
(b) Covers only 1886-1891

Colonel Potter concludes that the percentage of runoff is returning to that which existed before deforestation took place, the reforestation having been most active in the period 1899-1905 and, indeed, that theh downward trend of the percentage indicates that increased cultivation and scrub growth are reducing the percentage of runoff to less than it was under primeval conditions.

It is evident from the above table that in general the wetter the seven-year period has been, the greater has been the percentage of runoff. In the opinion of the writer the variation in the percentage of runoff is due so largely to the variation in the amount of rainfall as to conceal, at least to a large degree, the effect caused by changes in forest growth. The following quotation from Meyer's "Elements of Hydrology," p. 279, gives an excellent definition of "runoff" and is illuminating in the present case:

> Runoff is the technical name applied to that portion of the precipitation which is carried off from the land area into the ocean through surface channels. It constitutes the residual precipitation after evaporation, transpiration, and deep seepage losses have been supplied. Being a *residual*, runoff necessarily cannot be a *percentage* of the rainfall, i.e., the runoff must be determined by deducting losses from precipitation and not by taking a percentage of the precipitation.

The following table shows the annual rainfall, the annual evaporation and transpiration and the annual runoff as obtained from data in Colonel Potter's article and the records of the Weather Bureau:

Period	Mean Rainfall Inches	Evaporation and Transpiration Inches	Run off Inches
1885-91	24.7	19.7	5.0
1891-98	26.6	20.6	5.0
1899-1905	29.5	19.4	10.1
1906-12	24.4	18.6	5.8
1913-23	24.2	18.6	5.6
1917-23	22.0	17.8	4.2

Although the base data may not be strictly satisfactory in all respects, the table illustrates very well the principle expressed in the above definition of runoff. It shows what has been well known for a long time by engineers of the U. S. Geological Survey, that in a region like the upper Mississippi, where the annual precipitation exceeds about 20 in., the losses by evaporation and transpiration on land areas are fairly constant as compared with the runoff. In this case they apparently amount annually to an average of about 20 in. in depth on the basin in the wettest periods and about 18 in. in the driest periods. Little weight can be given to the figures in the first period as the records of rainfall are incomplete. So far as the effect of varying conditions of forest growth exists it should be found in the column of the second table showing evaporation and transpiration. The main thing which this column shows is that evaporation and transpiration are somewhat greater in wet years than in dry years, which is what one would expect. For these reasons it is believed that the data are inconclusive as showing any effect upon runoff due to the change from primeval conditions to the present conditions of cultivation and scrub growth.

R. W. DAVENPORT, Hydraulic Engineer, Federal Power Commission.

Washington, D. C., April 15, 1925.

Sir—In reading the article in *Engineering News-Record* on suggested ways of Mississippi River flood prevention it occurs to me that the arguments against spillways as a solution of the problem although perfectly logical as far as they go, show a lack of the "Yankee ingenuity" mentioned by the author in another part of the same article.

To sum up, the contention is that if a portion of the volume of water be removed at a certain point the result would be nil owing to sedimentation caused by increased velocity; this sedimentation causing eventually the same water level by restricting the hydraulic section. This argument is perfectly sound and cannot be refuted. However suppose that at the spillway twice the volume of water necessary to reduce the flood to less than danger point should be removed through a concrete channel carrying it at the same velocity to a convenient location where the section be enlarged thus reducing the velocity and causing sedimentation, and at that point sufficient water be allowed to pass through apertures in the bottom of the canal to flush it out continually, and carry the sediment to a site suitable for wasting it, thus insuring that the main channel does not clog up; and the one-half excess of volume now free of sediment be returned to the river channel at the nearest possible point below the spillway, would not its renewed capacity for taking up and carrying sediment counteract the sedimentation due to lost velocity? Of course between the spillway and the point of return the river undoubtedly would form bars and reduce its channel but below that point it seems logical to conclude that there would be no further sedimentation and a consequent drop in the water level.

E. C. PRATT.

La Romana, Dominican Republic, April 18, 1925.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

River Disaster Marks End of Mid-South Engineering Convention

Twenty-Two Persons Are Either Dead or Missing When Steamer "Norman" Capsizes on Mississippi

Special dispatch from W. W. DeBerard, Western Editor of "Engineering News-Record," who was aboard the "Norman"

Twelve engineers, five women of their party, a boy and four members of the crew of the stern-wheel steamer "M. E. Norman," were lost on May 8 when that boat, carrying a part of an inspection party from the First Annual Convention of Engineers of the Mid-South, capsized in mid-stream of the Mississippi near Coahoma Bend about 12 miles south of Memphis. As this was written only three bodies had been recovered but checking over the list of those known to have been aboard those lost are as follows:

Paul H. Norcross, consulting engineer, Atlanta, Ga.

William M. Gardner, U. S. Assistant Engineer, Memphis, Tenn.

Charles H. Miller, pres., Miller-Butterworth Co., Little Rock, Ark.

Ralph Bosard, Morgan Engineering Co., Memphis (body found).

Mrs. R. Bosard and son, Edgar (body found).

Charles E. Shearer, consulting engineer, Memphis.

S. Waters Fox, Joyce-Watkins Co., Paducah, Ky.

Edmund H. Bowser, Supt., Illinois Central Timber Treating Dept., Memphis, Tenn.

George L. Anderson, chief draftsman, Ayres & Miller, Memphis, Tenn.

Walter G. Kirkpatrick, prof. of municipal engineering, University of Mississippi (body found).

Mrs. W. G. Kirkpatrick

William Hannum, supt. of const., Phoenix Utility Co., Memphis

Robert H. McNeilly, prof. of civil engineering, Vanderbilt University

Mrs. Lydia Hidinger, mother of L. L. Hidinger, Pres., Morgan Engineering Co., Memphis

Mrs. J. H. Dorroh, wife of Prof. J. H. Dorroh, University of Mississippi

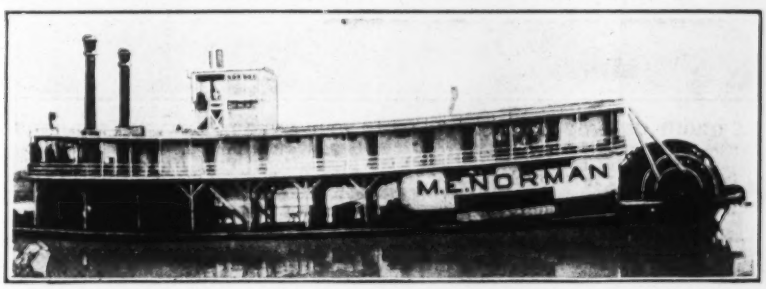
Mrs. L. W. Caldwell, Memphis, Tenn.

William O. Walker, resident engineer, H. W. Nelson Co., Fulton, Ky.

4 members of the crew.

As closely as can be ascertained the engineers among survivors are as follows: James Wood, William Richards, C. C. Reams, J. H. Haylow, G. W. Miller, A. S. Fry, W. G. Stromquist, Joe Carey, George W. Foster, L. L. Hidinger, C. C. Cagle, C. W. Okey, H. A. Wiersma, Major D. H. Conolly, Major D. H. Gillette, H. N. Pharr, R. O. Schaefer, W. F. Schulz, M. L. Richardson, Denny F. Barry, all of Memphis; A. M. Lund, Little Rock; John F. Coleman, New Orleans; E. H. Klyce, Nashville; R. E. Worden, Little Rock; J. R. Rhyne, Corning, Ark.; W. L. Winters, Fort Smith, Ark.; A. C. Butterworth, Little Rock; Capt. C. H. West, member Mississippi River Commission; W. W. DeBerard, Chicago; Major J. R. Fordyce, Hot Springs, Ark; J. S. Allen, Greenville, Miss., M. G. Overstreet and Prof. J. H. Dorroh, University of Mississippi.

The river excursion came at the end of the convention. Over a hundred of the engineers and their guests embarked at Memphis in the afternoon on two typical Mississippi River steamers, the "Choctaw" and the "M. E. Norman" to inspect the revetment and mattress work at Cow Island Bend. On the way back the "Choctaw" took the lead and reached Memphis safely. En route the "Norman" started listing to such an extent that the passengers were called upon several times to trim ship. The accident took place suddenly, however, at a time of calm and when the vessel was in not overly swift current near Coahoma Bend. The sequence of events can best be described by a personal account.



MISSISSIPPI RIVER BOAT WHICH SANK WITH PARTY OF ENGINEERS

Personal Account of Accident

We were in the cabin of the "Norman," about twenty of us, deliberating over the question of forming a local section of the American Society of Civil Engineers. Paul Norcross had just made an impassioned plea for members of the society to recognize the transitory nature of our existence and our duty to younger men by local service. Professor McNeilly also pleaded for help for the young man from his elders. J. H. Haylow, president of the Memphis Engineers Club, John F. Coleman, C. H. West, A. M. Lund and Prof. Kirkpatrick, had all urged action from altruistic considerations. L. L. Hidinger was about to propose the formation of the section when all proceedings stopped. A cry went up to the assemblage to shift to the high side of the boat. This was around 5 p.m. Since this same order had been given twice before, no one was flurried or felt uneasy; all started to comply. The engineers with clear-headed rapid precision turned within a few seconds to lightning-like physical decisions meaning life or death to family and friends. There was no hysteria, no complaints, no ifs, ands or buts, only plain action, duty and heroism of highest type, for not a report has reached any one of any but unselfish acts.

Before it was possible to move far, however, the boat continued to list with the lower side awash and everybody in the assemblage rushed out of an enclosure at the bow of the boat through a screened-in portion outside of this first enclosure. The boat listed so fast that few were able to adjust the life preservers, and most of those who had not already jumped were precipitated into the water. This action probably did not take longer than 30 seconds.

Practically everybody except three or four men had leaped from the high side of the boat. As for myself and the three or four men who had been catapulted into the water from the lower side of the boat, we swam for perhaps three minutes, picking up floating debris, and then made our way to the boat which had turned turtle, and managed to get hold of the upturned hull. Soon, however, a cry went up that the boat was going down by the stern, and this action and a rolling motion precipitated those of us on the bottom of the boat a second time into the water. I grasped a life boat which had turned turtle, rode that for a few minutes, and on the instruction of Major Gillette, cut one of the hawsers which held the life boat to the large boat. This released a number of life preservers which were in the boat, but almost immediately the large boat sank, and other life boats were sufficiently entangled so that they and the one I was on sank with it. Thus I was precipitated for the third time into the water. Luckily, oars in the life boat floated at hand and I grasped three of them which carried me safely for the next hour.

A motor boat providentially, was

passing near the "Norman" when it capsized. To Tom Lee, a negro workman of the Tennessee Construction Co., who was in this motor boat, probably 90 per cent of the survivors owe their lives. The boat cruised back and forth among the floating survivors, picking up the women first and carrying them to the shore, where fires were built and where some shelter was found in a cabin. Some of the survivors walked through underbrush and swamp to the nearest telephone where aid was called from Memphis. Most of the survivors reached Memphis that night by boat and so far none has reported any ill effects of the accident.

As a personal note I can remark that floating down river with three oars is a hardship only in that cold caused cramp which passed as I straightened my legs. After going ashore on the bar, warm sand served as first aid before the mile walk to the first bonfire helped start circulation. The editorial instinct came back at the bonfire where the prime essential of getting the names of relatives asserted itself. Though my camera had been lost I discovered a film roll undamaged in my pocket and from it there were produced ten good pictures, thanks to the quick and efficient development work by the Memphis *Commercial-Appeal*. [Three of these pictures are shown herewith]. By the time reporters arrived the list was completed so they lost no time in getting under way back to phone connections. I begged to go along so I could check up on their observations.

Prof. Dorroh's experience paralleled my own, in that in rushing to the top deck, the pilot house passed over him. His 14-year old boy scout son was one of the few who swam ashore unaided. James Wood and his wife were aft on the boat and not in the meeting. They merely walked dry shod around the boat as it rolled. Mr. Wood says that when it went down by the stern he swam, holding up his wife a few minutes until Tom Lee got them.

Up until Tuesday night, when this was written, all efforts to reach the wreck or to raise it have failed. Nothing humanly possible the Corps of Engineers could do was left undone. They welcomed civilian suggestions. Equipment consisting of their revetment tenders, a long tow boat, a sand dredge, a derrick, two steel barges, two sailor flats and several gasoline launches, were continuously occupied at wreck. Majors Connolly and Gillette were on duty continuously.

No survivors were found, though the river was patrolled for 18 miles. On Saturday an anchor caught a wreck located 300 ft. from Tennessee Shore at Coahoma light where the river sets against the 20-ft. bluff with a very high velocity .

Colonel C. L. Potter, president of the Mississippi River Commission, spent Sunday and Monday directing the search for bodies in the sunken ship. Three divers, brought from up river, declared that the current was too swift to permit any underwater work; and in a trial a diver was carried partially down the anchored cable but the current bellied the cable so much that he could not reach the anchor and was swept downstream until hauled abroad by half a dozen hands. Colonel Potter then ordered the demolition of the cabin by the raking method. Raising will be attempted by swinging chains under the hull and jacking up the ends of the chain on adjoining barges. Blind fishing rather than divers will have to be depended upon to place the chains in water 55 ft. deep.

The "M. E. Norman" was a new tow-boat purchased by the Mississippi River Commission early this year. She was a typical steel-hull stern-wheeler, 111 ft. long and 26 ft. beam, driven by oil engines. She had been tested thoroughly early this year on an 800-mile trip carrying more than double the load carried on May 8. In a recent test the rudder was held hard down to drive the boat in a circle at full speed. Practical navigation experts of the Commission had pronounced her entirely satisfactory. One hour before excursion started, Mr. Prewett, the superintendent of floating equipment, tried all siphons and found the hull dry. All hatches were battened down with gaskets and the boat declared in ship-shape order. As a special safety measure two extra skiffs were carried and a fifty per cent excess of life preservers. The speed with which the "Norman" turned turtle precluded launching the skiffs or making wide distribution of the preservers, though an unidentified hero passed out preservers up to the last second before the final plunge.

A GROUP OF THE ENGINEERS TAKEN JUST BEFORE LEAVING MEMPHIS

The fourth man from the left, front row, is S. Waters Fox; E. H. Bowser is to the right of the man behind the small boy in the front; Prof. Kirkpatrick stands behind the two men to the right of the boy; Major Gardner stands to the left of the man behind the little girl; W. M. Hannum stands in front of the column at the left of the door, and C. E. Shearer to the right of the third column at the right.

PAUL NORCROSS IN THE CENTER OF A GROUP AT MEMPHIS

GOING ABOARD A BARGE TO INSPECT MATTRESS WORK

Photographs taken by W. W. DeBerard an hour or two before accident

Engineers Who Lost Their Lives When the Norman Sank

Brief biographies of the twelve engineers, all members of the American Society of Civil Engineers, who lost their lives when the river boat "M. E. Norman" sank on the Mississippi River near Memphis, Tenn, May 8, 1925.

CHARLES HENRY MILLER was born in Lancaster County, Pa., Nov. 30, 1866, and graduated from Lehigh University in June, 1888, with the degree of civil engineer. He began active work the same year on the Mississippi River under the U. S. Army Engineer Corps, as instrumentman, draftsman, assistant engineer, chief of survey parties, and superintendent of construction on surveys, dredge work, and levee construction. In 1901 he went to Pittsburgh as superintendent of construction on the Pittsburgh plant of the McClintic-Marshall Construction Co., remaining there four years. From 1905 until 1911 he was engineer of river protection for the Missouri Pacific & Iron Mountain Ry. System, at the same time acting as a consultant for other railroads on similar work. In 1911 he became president of the Miller Engineering Co., now the Miller-Butterworth Co. of Little Rock, Ark., which position he has held continuously since that date except for the two years he was in the army, when he was for a time construction quartermaster at Camp Cody, and later went to France in command of a battalion of the 23rd Engineers.

CHARLES ENGLISH SHEARER was born in Marion County, Ind., May 17, 1881, and graduated from Purdue University in 1905. From 1905 to 1906 he was first with the bridge department of the Delaware, Lackawanna & Western R.R. and then for a time with the McClintic-Marshall Co. In 1906 he went to the Memphis Bridge Co. as a designer, and later as chief engineer, remaining with the bridge company until 1910 when he opened an office of his own as a consulting structural and industrial engineer at Memphis, Tenn. From June, 1918, until May, 1919, Mr. Shearer was with the U. S. Bureau of Insular Affairs on the design of the Jones Bridge in the Philippine Islands.

RALPH BOSARD was born at Indianapolis, Ind., in 1889, graduated from Purdue University in 1913, and entered the employ of the Morgan Engineering Co., Memphis, Tenn., as a construction inspector the same year. Since that time he has been continuously in the employ of the Morgan Engineering Co., on various river and draining projects in the South and Southwest.

EDMUND HAMILTON BOWSER was born at Louisville, Ky., Jan., 1856, completed the course in engineering at Vanderbilt University in 1882 but did not graduate on account of illness. After leaving the university Mr. Bowser was for 11 years in railway and general engineering work in the South until in 1896 he went to the Illinois Central R.R. as assistant engineer, later becoming roadmaster, and in July, 1899, going to the Louisville & Nashville R.R., as assistant engineer in charge of dredging and wharf work at Pensacola, Fla. In 1902 he became superintendent of the creosoting work operated by the L. & N. R.R., in 1903 general manager, Southern Creosoting Co., and in 1904 returned to the engineering department of the L. & N. R.R. Mr. Bowser became superintendent of the tie and timber treating department of the Illinois Central R.R., in 1906, which position he has held since.

GEORGE LEE ANDERSON was born at Poland, Ind., Oct., 1894, and graduated from Purdue University in 1921. Previous to this time he had been employed in the U. S. Engineer's Office at Memphis, Tenn., on Mississippi River surveys and in the employ of Ayres & Miller, consulting engineers on drainage work. After graduation from college he re-entered the employ of Ayres & Miller. During the War Mr. Anderson served with the 472nd Engineers at Fort Sill, Okla.

WALTER GILL KIRKPATRICK was born in 1859, and graduated from Vanderbilt University in 1886, obtaining his degree of civil engineer the following year, having been for two years a Fellow and assistant in the Engineering Department of the university. After leaving the university he was for a time in municipal and railway work in Tennessee and in 1892 became a member of the firm of Landreth & Kirkpatrick in Nashville. Following this he was successively U. S. assistant engineer on the Cumberland River system of locks and dams, secretary of the Engineering Association of the South, assistant on design of cantilever bridge and sewer system, St. Johns, Mich., acting professor of Civil Engineering, Union College, and engineer in charge of the Tennessee Centennial Exposition. About 1896 Mr. Kirkpatrick returned to private practice as a consulting engineer in the South, later becoming city engineer of Jackson, Monroe, and Birmingham, Ala., and engineer for the Alabama Power Co., returning to private practice again in 1914. In 1923 Mr. Kirkpatrick became professor of municipal engineering in the University of Mississippi.

WILLIAM HANNUM was born in Christiana, Pa., in 1890 and graduated from Pennsylvania State College in 1912. After graduation he entered the employ of the J. G. White Engineering Corp., leaving them for a year to become a member of the firm of McCool & Hannum, contractors on sewer work in Philadelphia, returning in 1917 for work on the construction of the U. S. Nitrate Plant at Sheffield, Ala., remaining with them until a short time previous to his becoming Superintendent of Construction for the Phoenix Utilities Co., Memphis.

ROBERT HUGH MCNEILLY was born at Danville, Ky., in 1880, received his bachelor degree in engineering from Vanderbilt University in 1902, and his degree as a civil engineer in 1915. Previous to graduation he was employed on railroad and municipal engineering work in the South, becoming resident engineer on construction for the Springfield (Tenn.) Water & Electric Light Plant in 1904, and continuing on similar work until in 1905 he became assistant professor of civil engineering at the University of Mississippi, also practicing civil engineering as a member of the firm of Drane & McNeilly. From September, 1907, to date (except for one year on the construction of a graphite plant in Alabama) Professor McNeilly taught engineering at Vanderbilt University, becoming professor of civil engineering in 1922. During this time he continued to practice as a consulting engineer through the summer vacations.

WILLIAM MONTGOMERY GARDNER was born at Augusta, Ga., in 1868 and began active work as a rodman on railroad construction and later as an instrument man in the city engineer's office, Memphis, Tenn. In 1890 he became an instrumentman on the Mississippi River Commission, and in 1892 became U. S. assistant engineer on Levee work on the Mississippi River, in charge of the Yazoo Levee District under the Mississippi River Commission, and the upper Yazoo and the White River Levee District. At the time of the accident Major Gardner was in charge of the river work being inspected.

PAUL HOWES NORCROSS was born at Atlanta, Ga., Jan. 19, 1880, and graduated from Georgia School of Technology in 1902. Shortly after graduation he entered the employ of the Carolina Steel Bridge & Construction Co. (later consolidated with the Virginia Bridge & Iron Co.) becoming successively structural draftsman, assistant construction engineer and construction engineer in charge of the Burlington, N. C., office. From Nov., 1905, until Jan., 1906, he was a structural designer with the Pennsylvania R.R., from Jan. to April, 1906, with the bridge department of the New York Central. From May, 1906, until Jan., 1918, he was a member of the firm of Solomon-Norcross Co., engineers, Atlanta, Ga., on surveys, design and construction of various projects including water supplies, sewerage systems, sewage disposal, and hydro-electric developments in the southern states. During the war, Mr. Norcross was supervising engineer, construction division, at Camp Jackson, S. C., Camp Humphries, Va., and North Camp Jackson, S. C., also assistant engineer on water supplies for various camps and land acquisition agent for the War Department at Camp Jackson, Camp Gordon, Ga., and Camp Benning, Ga. Following the war, Mr. Norcross returned to Atlanta, Ga., and continued his practice as a consulting engineer, specializing in water supply, hydro-electric, sanitation, valuation of public utilities, reports, etc. He was a member, and secretary, of the Engineering Board of Review of the Sanitary District of Chicago which reported last January. Mr. Norcross was elected a director of the American Society of Civil Engineers last January, and was in Memphis at this time in pursuit of his conscientious effort to promote the engineering activities in his district.

STEPHENSON WATERS FOX. (A complete record for Mr. Fox is not available.) He graduated from Rensse'aer Polytechnic Institute in 1876 and in

(*Continued on page* 831)

Construction Council Holds Spring Meeting

The American Construction Council, meeting at New York on May 8 and 9, devoted its private sessions to a consideration of methods of raising funds for the promotion of its activities and the two public meetings to better building of small houses and seasonal construction, respectively. The discussion of the latter was along conventional lines and developed little or nothing that was new. In the better building session the foundation was laid for a campaign to persuade builders, realty men and owners of the ultimate benefit to be derived from better small residences.

Col. Kelly to Join N.E.L.A.

Col. William Kelly, Corps of Engineers, U. S. A., who has been chief engineer of the Federal Power Commission since its creation, is winding up his work preparatory to the assumption of new duties as director of engineering for the National Electric Light Association, with headquarters in New York City. He will retain his title of chief engineer until after a meeting of the Commission to be held later this month, so he may participate in that meeting at which a number of important matters must be decided. This announcement supersedes the report made some months ago that Colonel Kelly was to become connected with the Niagara Falls Power Co.

Regional Planning Boards

Any county or counties and the cities, towns and villages of any county or counties in New York State may establish a regional planning board under the General Regional Planning Law recently approved by the Governor.

Moffat Tunnel Heading Advances at a Record Rate

During the month of April, working in hard rock, the east portal heading crew made an advance of 1,386 ft., made up of 688 ft. of water tunnel, 691 ft. in the main heading, and 7 ft. in the crosscut. The enlargement of the railroad tunnel working one shift has advanced 564 ft. during the month of April.

During the last half of April the east portal crew made 261 ft. of bonus money or $57.30 each for the drillers. This is far greater than any previous period, as the total heading driven by the one crew from the east portal was 771 ft. in the 15 days. The contractors, Hitchcock & Tinkler, Inc., believe that this record has not been surpassed on any other tunnel construction.

Engineering Council's Board Has Meeting

American Engineering Council, through its Administrative Board meeting in Philadelphia May 8 and 9, considered more intensive work in commercial aviation and active promotion of a department of public works as leading subjects for the immediate future.

In the matter of aviation the board voted to undertake an exhaustive investigation of the aircraft situation. The various aspects of the problem, military and civil, will be thoroughly sifted by a special committee, which is expected to occupy one year in the task at an estimated cost of $50,000. This action followed the adoption of the report of the Council's Aeronautics Committee, of which Prof. Joseph W. Roe, head of the Department of Industrial Engineering in New York University, is chairman. The report warned that the present confused situation is a national menace both as to preparedness and as to commercial development. Great danger to investors exists, it was asserted, owing to the uncertain conditions which prevail.

Discussion took place among the engineers over the question whether the preparedness factor should be stressed in the inquiry about to begin. Dr. H. E. Howe of Washington, treasurer of the Council, declared that the possibility of war should not be ignored, and that Japan and Germany were working closely together in developing chemical warfare. Prof. C. F. Scott of Yale expressed the view, shared by several other members of the board, that the investigation should emphasize commercial aviation. The resolution as finally adopted provides for the consideration of both civil and military conditions.

The board further adopted the report of its committee on U. S. Government Reorganization, which substantially favors the Mapes bill carrying out the plan of the congressional committee on reorganization. The Council will drop its effort to bring about the creation of Assistant Secretaryships of Public Architecture and Public Construction, adhering to the proposal for the establishment of a Division of Public Works and a Division of the Public Domain. A bill embodying the Council's proposals is being prepared for introduction in Congress. The Jones-Wyant amendment to the Mapes bill, making provision for four assistant secretaries instead of two, will not be pressed. The next session of Congress, therefore, will have before it both the Mapes bill and the bill to be sponsored by the Council.

The resignation of Rudolph P. Miller of New York as the Council's representative on the National Board for Jurisdictional Award, effective Aug. 1, was accepted. Mr. Miller, in a report to the Board, asserted that strikes due to trades union disputes in the building industry were rapidly being eliminated as the result of the Jurisdictional Board's effort, and that the decisions of the Board as umpire were being generally respected by labor.

A large and enthusiastic dinner meeting was held at the Philadelphia Engineers Club on the evening of May 8. Gardner S. Williams of Ann Arbor, Mich., vice-president, presided over the board's sessions in the absence of President James Hartness, who is ill.

Big Meadows Dam Being Raised to Store 1,300,000 Acre-Ft.

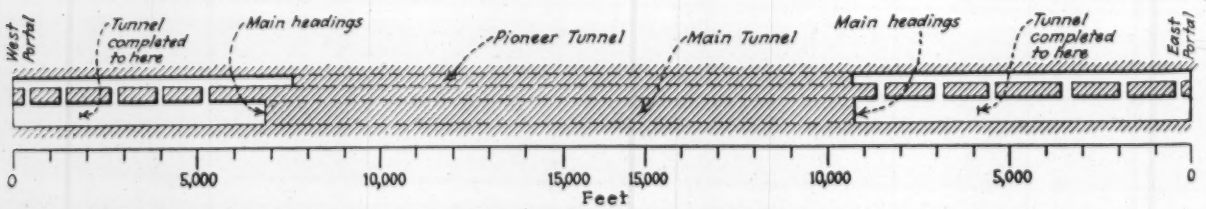
The Big Meadows dam of the Great Western Power Co. on Feather River in California is being raised 45 ft., the work having started early in April. This additional height will increase the capacity of the reservoir, known as Lake Almanor, from 300,000 to 1,300,000 acre-ft., which is said to exceed the storage capacity of all other California reservoirs combined. This great capacity is expected to stabilize power production on this system by storing season-to-season runoff. About 13,500 acres of land beyond the previous high water line will be flooded by the height increase. The watershed tributary to this reservoir has an area of 504 sq.mi. and includes numerous springs noted for their uniform flow.

The Big Meadows dam is of the hydraulic earth-filled type and was built in 1913. It is now 80 ft. high and when raised to a height of 125 ft. will be 1,250 ft. long on the crest. The yardage in the present structure is about 500,000 cu.yd. to which an addition of approximately 1,000,000 cu.yd. will be made.

The work at Big Meadows is a feature of the power company's $200,000,000 program for the development of Feather River power holdings. In the 75 miles below this dam the river drops some 4,000 ft. and the company's ultimate program contemplates the construction of ten power plants in this stretch of the stream to take full advantage of the stored water. Ultimately it is planned to develop a total of 1,000,000 hp. in the Feather River below the Big Meadows dam.

The start of work on this dam coming shortly after the consolidation of the Great Western Power Co. and the San Joaquin Light & Power Corp., is understood to be preliminary to the extension of power lines of the consolidated system.

The contract for the construction work has been let to the Foundation Co.



PROGRESS PROFILE OF MOFFAT TUNNEL UNDER THE COLORADO ROCKIES, MAY 1, 1925

Road Builders Show Nets $44,000, Is Report at Annual Meeting

At the banquet of the Engineers Club, New York City, following the annual meeting, May 11, at the Engineering Societies Building, Charles M. Upham, convention manager, reported that the American Road Builders' Association's road show held in January at Chicago had netted the organization approximately $44,000. Total receipts amounted to about $116,000. This indicates the most financially successful show the association has yet held. The report of James H. McDonald, treasurer, showed that the assets of the association are now approximately $64,000.

William H. Connell, engineering executive and deputy secretary of highways of the state of Pennsylvania, was inducted into office as president of the association at the banquet. He stressed the need for a thorough realization of the immensity of the industry for which the association is official spokesman, and the large opportunities for service which lie before it. The following were named as members of the executive committee: J. H. Cranford, retiring president, to represent the contractors; H. G. Shirley, chairman of the Virginia State Highway Commission, to represent the highway officials; and S. F. Beatty, of the Austin Manufacturing Co., to represent the manufacturers. Mr. Connell and Mr. McDonald are members of the executive committee by virtue of the offices they hold. W. A. Van Duzer was elected to the board of directors to fill the place made vacant through the election of Mr. Connell to the presidency.

Code of Ethical Practice

The code of ethical practice of the Associated General Contractors of America, (1038 Munsey Building, Washington, D. C.), will soon be available for distribution in pamphlet form. The code proper is prefaced with a statement by the A. G. C. committee on ethics.

Engineers Who Lost Their Lives When the "Norman" Sank

(*Continued from page* 829)

1880 became U. S. assistant engineer and chief of the St. Joseph Division of the improvement work on the Missouri River. During the war he served as a colonel in the reserve becoming engineer of contracts, Division of Inland Waterways, U. S. Railroad Administration, Washington, D. C.

WILLIAM OLIN WALKER was born at Chucky City, Tenn., in 1892 and began active work in 1907 as a rodman on the New Orleans & Texas Pacific R.R., later going to the Illinois Central R.R. in the engineering department, remaining with that road until in 1920 he went to the U. S. Railroad Administration. In 1920 Mr. Walker entered the employ of the Sinclair Refining Co. at Coffeyville, Kan., remaining with that company until last year when he went to the H. W. Nelson Co. as resident engineer in the Illinois Central construction at Fulton, Ky.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Convention, Orlando, Fla., June 2-5, 1925.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Union College, Schenectady, N. Y., June 17-20, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Summer Meeting, Salt Lake City, July 8-10, 1925.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Meeting, Des Moines, Iowa, Oct. 26-29, 1925.

The Mid-South Convention at Memphis May 7 and 8 without definite organization other than that of the local Memphis Engineering Club proved to be a valuable professional asset in bringing together about 150 engineers of eight middle south states. Had the boat disaster not occurred permanent organization undoubtedly would have been launched. Problems of sewage, water, city planning and how to get business were handled in two sessions the first day. Paul Norcross described the Chicago Sanitary District situation, M. Z. Bair, factors in small water and sewage practice, Harlan Bartholomew city planning results in Memphis which have opened and widened many new direct thoroughfares. W. W. DeBerard spoke of the engineering editor's job. Reliance placed on the all-day excursion for achieving the get-acquainted idea succeeded admirably. The clock-like automobile trip over Memphis belt of boulevards taken at thirty miles per hour, "ordered" by Chief of Police Tom Allen, an engineer, permitted maximum time at new water-works and new Ford assembly plant. Modern mattress revetment at Cow Island Bend inspected through courtesy U. S. Engineer Corps in charge of Major D. H. Connolly disclosed 1,100-ft. mattress 250-ft. wide stretched away below anchor barges ready for filling with rock by short units of belt conveyors. Within an hour came disaster to one of excursion boats, which precluded the evening session with address by L. W. Baldwin, president, Missouri Pacific R.R.

Personal Notes

GEORGE W. SIMONS, JR., for nine years chief sanitary engineer of the Florida State Board of Health, has resigned, effective May 1, to become chief engineer of the Consolidated Development and Engineering Corporation, Inc., Jacksonville, Fla. Mr. Simons will devote his attention to the practice of municipal engineering in the southeast, specializing in water supply and purification, sewerage, sewage treatment, refuse disposal and city planning.

E. G. ORBERT, consulting civil engineer, and W. T. GOHN, recently building inspector of the city of West Allis, Wis., have opened an engineering office at West Allis.

JOHN B. STEVENSON, assistant chief engineer of the Bureau of Engineering, Pittsburgh, Pa., in charge of the Division of Bridges, has resigned. Mr. Stevenson has been head of the Division of Bridges for seven years and has been in the city's service for nineteen years, starting as an inspector.

HARRY LEWIS, engineer in charge of street repaving work, Pittsburgh, Pa., has resigned to go into business.

CARL W. PORTER, who has since his graduation from the University of Michigan been employed in the design department of the Newport News Shipbuilding and Dry Dock Co. at Newport News, Va., has been commissioned a lieutenant, junior grade, in the Corps of Civil Engineers, U. S. Navy, and, following a few months of training in the Bureau of Yards and Docks, Navy Department, will be ordered to the Public Works Department of one of the large navy yards.

JAMES ALLEN, former state highway engineer of Washington, has incorporated the James Allen Engineering Co., with Offices in Olympia, Wash.; with Mr. Allen will be associated WILLIAM YEAGER, JR., former county engineer of Thurston County, Wash., and HUGH GOVAN, of Port Angeles; the firm will engage in highway construction work and general contracting.

Obituary

A. M. BURT, vice-president in charge of maintenance and operation, Northern Pacific Ry., died at Jamestown, N. D., on April 20. Mr. Burt was born in Syracuse, N. Y., May 1, 1866, and began his railway service in the engineering department of the Colorado Midland R.R. in 1885. He soon went to the Northern Pacific Ry. and continued in its service in various positions in the engineering and operating departments. From June, 1919, until March, 1920, Mr. Burt served as assistant director, division of operation U. S. Railroad Administration. Mr. Burt was very active in the affairs of the American Railway Engineering Association, and was a member of the Board of Direction at the time of his death.

JOHN K. MITCHELL, assistant city engineer of Detroit, died May 5 at the age of 69, after a service of 50 years. He was born in Detroit and entered the department of public work as a rodman in 1875. As the engineering work of the city increased with its growth in population and area, Mr. Mitchell assumed charge of the paving division of the department. During recent years Detroit's extensive paving programs have been carried out under his direction.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Standardization of Elevated Steel Water Tanks

By J. E. O'Leary
Pittsburgh-Des Moines Steel Company

(Abstract of paper presented before the Annual Convention of the American Water Works Association at Louisville, Ky., April 27-May 1.)

THE design, manufacture, and erection of elevated steel tanks and standpipes have developed into a highly specialized industry to which a number of companies devote practically their whole energy. As might naturally be expected this specialization has resulted in almost uniform products both in appearance and design. Furthermore, fully 75 per cent of all specifications call for tanks and standpipes to be furnished on practically the same basis as they do pumping equipment. That is, they specify the capacity in gallons and the height to which this capacity is elevated in the case of tanks, while in pumping equipment, the capacity in g.p.m. and the pumping head are the vital factors. It is also common for the engineer to specify the allowable working stresses, the loads, and the size of pipe connections. The design and details are left almost entirely to the manufacturer.

Survey of Tanks in Service

In approaching the subject of standardization, the company with whom I am connected made a careful study of the elevated tanks they had previously built. As a result of a tabulation of the tanks built in the five years preceding the study, it was found that there were 21 different sizes and 13 different capacities. Of the 21 sizes of tanks, 82 per cent was in 9 sizes representing only seven different capacities —25,000, 30,000, 40,000, 50,000, 60,000, 75,000 and 100,000 gallons each. We, therefore, felt quite justified in adopting these seven capacities of tanks as standards.

Greater variation was encountered when the tower heights were investigated. Elevated tanks are used by three distinct classes — municipalities, railroads and industrial plants. Different customs in these three industries in specifying the tower height, accounted for much of this variation. We adopted the height to minimum water line as standard since it not only seemed most logical but also was largely used by both railroads and industrial plants. Although the variation in height was large, nevertheless, the tendency of the structures to fall within certain group limits was very marked. On railroad tanks, 20 ft. was a very common tower height; sprinkler installations fell into two groups around 75 and 100 ft.; municipal tanks offered the greatest variation but three distinct heights were common—50, 75 and 100 ft.

With these very definite facts as to tower heights before us, we have proceeded with our program of standardized elevated tanks. The capacities are limited to the seven mentioned previously, all of these capacities being standard for municipal and industrial installations, but only the 50,000 and 100,000 for railroad tanks. The standard height of tower for both these sizes of railroad tanks is 20 ft. Two tower heights for municipal and sprinkler tanks were fixed for all of the seven capacities, namely 75 and 100 ft. These we call our Class A standards which we can carry completely fabricated. The necessity of other tower heights than these caused us to form some Class B standards. These were amplified from Class A towers by varying the lengths of the columns in the middle and bottom panels.

Advantages to be Gained

Advantages arise from the standardization of design, fabrication, erection, and selling and estimating practices that are reflected in lower prices and higher quality. A complete set of detail plans for a 50,000 gallon tank on a 100-ft. tower would probably cost the average shop which did not have any standards at least $500 to make. If never used again, this item represents a substantial part of the cost of such a structure; but assume that 25 duplicate tanks be built from this same set of plans and the economy becomes self evident. What has been said of shop drawings applies equally well to shop templates. Because of the number of times the same template can be used on standardized work, we are enabled to make steel templates which eliminate any possibility of error due either to mistakes in laying out or to changes in weather conditions. In addition to this saving no marking of plates is required, the template being clamped onto the correctly sized plate and the punching done directly through the steel template. Standardization permits smaller stocks of plates and shapes to be carried with the resulting saving in interest charges. Furthermore, the steel can be ordered to exact size thereby eliminating the scrap or waste item which is a big factor on most fabricated jobs. Duplication and mass production are made possible by a system of standardization. A case in point is the dishing of hemispherical bottom plates. Previously the changing of the dishing machine to accommodate different diameters of tanks has been one of the time consuming elements that built up costs. The savings to be made by permitting the machine to dish on a single size of plates for a full day's run are self-evident.

While it is true that the greatest advantages and savings from a standardized product are most evident in the manufacturing end, still to a lesser degree is there some advantage gained in the erection of these structures. Erection equipment can be standardized due to the common varieties of tower height. The workmen also become more familiar with the small number of tank and tower sizes and work faster and more efficiently. Selling and engineering expenses are also decreased to a large extent by standardization. To design and estimate the cost of an average size tank or tower of special design will require the time of a good engineer for the better part of a day. When this same man can prepare proposals on fifteen standard outfits in the same time, the saving is quite apparent.

The Division of Simplified Practice of the Department of Commerce is attempting at the present time to interest all manufacturers of these structures as well as engineers and users in a program of elevated tower and tank standardization.

Standard Paver Capacities

Questions which have arisen over the real capacity of the paving mixer known as 21-E were discussed May 6 at Chicago, by representatives of the Mixer Manufacturers Bureau of the Associated General Contractors, state highway officials and equipment manufacturers affected by any change in the mixer ratings. The meeting, presided over by Gen. R. C. Marshall, secretary of the A.G.C., resulted in resolutions calling for a definite volume capacity for the standard paver of 25.3 cu.ft., to be tested as to capacity by the A.G.C. and so marked. The American Association of State Highway Officials is to be approached by a committee to effect cooperation and request adoption of the A.G.C. rating.

From a questionnaire sent to about thirty-five contractors, about 80 per cent indicated that they desired a mixer which would deliver a 6-bag batch when the aggregate proportion was 1:2:3½. Several makers of the present 21-E size will manufacture such a mixer, having been granted permission to do so by the Illinois State Highway Department for the 1925 season, pending settlement of the rating. Next year there is a likelihood that Illinois specifications will call for a 1:2:4 mix in which case the present 21-E size might not be satisfactory. Another move made was to appoint a committee to look into the foundation of an affiliate bureau to the A.G.C. similar to the Mixer Manufacturers Bureau but to include, in addition, the makers of unloading and proportioning equipment, trucks and equipment for industrial transportation since these companies are all interested in any changes in mixer sizes.

Business Notes

Smith Engineering Works, Milwaukee, manufacturers of rock handling machinery, have recently started construction upon a new factory which the management states, will double the company's output. Operations will be transferred to the new plant in October.

R. E. KINKEAD, former Chief Engineer of the welder division of the Lincoln Electric Co., Cleveland, has been transferred to the sales department as regional director of sales with offices in Buffalo, N. Y.

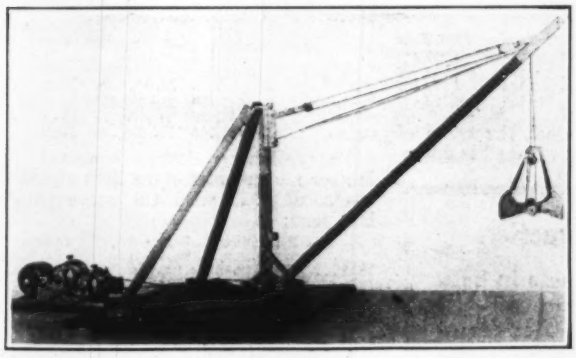
LEHIGH PORTLAND CEMENT CO., Allentown, Pa., has recently purchased the Hudson River Mill of the Alsen Co., Alsen, N. Y. This mill, together with the two mills of the Bath Portland Cement Co., Bath, Pa., leased earlier in the year, makes a total of nineteen mills now under the control of the Lehigh company. The annual capacity of these mills will be approximately 20,000,000 barrels per year.

PITOMETER CO., New York, has been retained by the city of Providence, R. I., to make a study of existing water distribution facilities, and to prepare a 25-year program for the necessary water main extensions and renewals.

Equipment and Materials

Miniature Construction Equipment

Exact reproductions of several kinds of construction equipment are featured by the Noble Mfg. Co., Hartford, Conn. under the name of "Trumodel Toys." These products are not toys in the common sense of the word but are built to scale in every detail. Such examples as aluminum alloy, brass and bronze castings, cut gears, ball bearings, ground steel shafts, and automatic lubrication



attest to the quality of this equipment. In addition to its sturdy construction, each model operates the same as standard equipment in every particular. Separate levers are used for the hoisting and swinging motions and dipper-trips are provided. An electric motor, taking current direct from any standard light connection, without the necessity of a transformer, is utilized as the power unit.

Although these miniature models are made primarily to stimulate the thoughts and actions of the boy "engineer," they, no doubt, have a field of application in sales demonstrations and exhibits. The manufacturer plans to keep abreast of progress in the construction equipment field, and to bring out new models each year with careful regard to standardization and interchangeability.

Finishing Intersections

The Lakewood finishing machine with an adjustable strike-off is well adapted to finishing intersections. The illus-

tration shows the machine, on a 24 ft. street, riding on false forms placed across the intersection at a height equal to that of the curb. The slab was finished five inches below the top of the curb. The corners of the intersection were finished by hand.

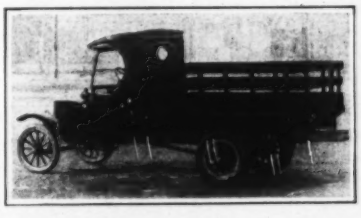
Other uses for the adjustable strike-off are in finishing the base before reinforcement is placed, and in finishing and tamping the concrete base for brick or bithulithic pavement.

New Stake Body for Ford Truck

The Ford Motor Company has added a stake body to its 1-ton truck equipment and distribution has begun through the dealer organization. The new body meets many commercial requirements and is designed for carrying farm produce, raw materials, manufactured articles and bulky material in general. The body may be used in combination with the all-steel cab. Stakes, which are easily removable, permit a platform truck of good proportions.

Except for floor and rack boards, which are constructed from seasoned wood, the body is all steel. The floor space is 5 ft. wide and 8 ft. 2 in. long. Sides rise 26 in. above the floor.

Racks are in five sections, two on



either side and one at the rear. Steel stakes, set in sockets in the outer steel frame of the platform, hold these sections together.

Publications from the Construction Industry

Gasoline Locomotive—GEO. D. WHITCOMB CO., Rochelle, Ill., in a 12-p. bulletin, has described the Whitcomb 7-ton positive gear drive locomotive and tells of its value in road work, batch mixing, cut and fill road work, industrial switching, rock quarrying, and stone, sand and gravel handling.

How to Use Cement—ALPHA PORTLAND CEMENT CO., Easton, Pa., has published a new, revised 112-p. handbook, "Alpha Cement—How to Use It." Among the uses mentioned are for engine bases, small bridges, culverts, curbs, floors, foundations, irrigation canals, pavements, retaining walls and steps, silos, and garages.

Concrete Work—PENNSYLVANIA CONCRETE CO., New York City, is distributing the "Pennsylvania Concrete Manual," a 48-p. booklet telling what portland cement it, how to test, store and handle it, and how to mix and use it for foundations, concrete structures, road building, sidewalks, floors, culverts and short span bridges, curbs and gutters, cisterns, septic tanks, and miscellaneous concrete work.

Winches, Cranes and Derricks—MEAD-MORRISON MANUFACTURING CO., East Boston, Mass., describes, in its 20-p. Catalog 25, seven types of winches, a single-line truck crane and a pole-setting derrick. The winches, which can be installed on practically any make of truck, cut down the number of men necessary on jobs of hoisting, hauling, house moving, loading and unloading, and are useful for telephone and public utility maintenance work.

Rock Drills—GILMAN MANUFACTURING CO., East Boston, Mass., has issued three bulletins, No. 100 on hand-held rock drills, No. 101 on mounted rock drills, and No. 103 on automatic heat-treating machines for rock drill bits. Among the purposes served by the rock drills are shaft sinking, drilling for trenches and foundations, for general rock excavation on railroads and highways, and for demolishing concrete walls and tearing up roadways; the heat-treating machine is designed to keep the drill bit in good condition by proper treatment.

Concrete Paving—AMERICAN VIBROLITHIC CORPORATION, Des Moines, Iowa, has issued a revised edition of its pamphlet "What Is Vibrolithic?" The answer given to the question is that it is an improvement on the methods used in concrete construction, by which dense concrete of maximum strength and wearing quality is laid rapidly and economically.

Brass Products—BRIDGEPORT BRASS CO., Bridgeport, Conn., has issued for distribution free on application a new data book containing prices and weights of sheet brass, brass rod, wire, condenser tubes, and seamless brass and copper tubes.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Materials Movements Show Seasonal Activity But Orders Portend Slackened Demand and Lower Prices

That the recent high rate of production in such materials as iron, steel, copper and textiles has been in excess of demand is shown by the curtailment programs now being observed at mills throughout the country.

With the construction volume heavier than at any time since May, 1922, the present movements of steel and lumber are not suggestive of a continuation of this demand.

Brick is seasonally active but does not promise a return to the high consumption volume of 1924.

Cement and concrete aggregates are moving in great volume and contrast sharply with the trends of steel and lumber.

All materials seem plentiful but the mills are burdened with the responsibility of carrying the reserve stocks of the nation. Freight cars being plentiful and rail deliveries prompt, the dealers and consumers buy in small orders, frequently repeated. The absence of scarcity serves to prevent a price rise in materials. The present high cost of skilled labor does not tend to prevent the gradual downward trend in construction cost, evident since March of this year.

Steel—The trend in steel demand and output is very much the same as that of a year ago, according to figures released by the American Iron and Steel Institute.

The calculated steel ingot production of all companies in the United States, totaled 15,740,851 tons for the four months ending Apr. 30, 1925. This represents a gain of 5 per cent over the corresponding period last year.

Unfilled orders on books of the U. S. Steel Corporation, Apr. 30, 1925, amounted to 4,446,568 tons, a gain of 6 per cent over those on hand at the same date last year.

This year, therefore, looks favorable compared with last, so far as demand and output are concerned.

The similarity in trend is shown by the accompanying tables. The April ingot output was 15 per cent under that of the preceding month. April, 1924 dropped 20 per cent below March of that year.

The unfilled tonnage as of Apr. 30 was 9 per cent lighter than that on hand Mar. 31, 1925. Last year a drop of 12 per cent was recorded between Mar. 31 and Apr. 30, 1924.

STEEL INGOT OUTPUT

	1925, Tons	1924, Tons
January	4,198,564	3,649,913
February	3,756,243	3,826,246
March	4,198,520	4,206,699
April	3,587,524	3,348,466
4 months	15,740,851	15,031,324

UNFILLED ORDERS

	1925, Tons	1924, Tons
January 31	5,037,323	4,798,429
February 28	5,284,771	4,912,901
March 31	4,863,564	4,782,807
April 30	4,446,568	4,208,447

Lumber—As with steel, the trend of lumber production and demand is downward. At the same time, the output and sales of this material are heavier than a year ago.

The following table compares the national lumber movement as reflected by the reporting mills of seven regional divisions of the National Lumber Manufacturers' Association:

	Week Ended May 2	Corresponding Week in 1924	Preceding Week in 1925
	M. Ft. b.m.	M. Ft. b.m.	M. Ft. b.m.
Production	244,813,430	239,299,839	254,426,417
Shipments	242,715,938	245,784,717	259,101,600
Orders	234,169,058	200,806,790	256,952,162

The following figures compare the lumber movement for the first eighteen weeks of 1925 with the same period last year:

	Production, M. Ft. b.m.	Shipments, M. Ft. b.m.	Orders, M. Ft. b.m.
1925	4,237,799,881	4,190,093,436	4,076,009,396
1924	4,243,293,753	4,288,961,490	4,094,308,213
1925 decrease	5,493,872	98,868,054	18,298,817

Brick—The Common Brick Manufacturers' Association of America states that "current reports from 116 manufacturers of common brick indicate that the high pressure demand of 1924 has diminished. The volume of brick moved during the past thirty days is in excess of that moved during the preceding months, but there has been no gain in orders for the future." The following table shows the situation compared with a year ago:

	Burned Brick on Hand	Unburned Brick on Hand	Brick Moved from Yards During Month	Orders on Books
1924	M.	M.	M.	M.
Apr. 1	250,118	46,226	142,197	335,926
1925				
Jan. 1	354,477	51,162	118,759	202,906
Feb. 1	279,862	23,951	94,185	201,479
Mar. 1	305,831	34,891	110,790	247,176
Apr. 1	287,800	43,446	170,697	329,673

(*Continued on p. 835*)

This Week's Contracts—Week Ago—Same Week Last Year

The money value of contracts reported in the present issue of *Engineering News-Record* is here compared with the figures for corresponding weeks.

Minimum costs observed are: $15,000 for waterworks and excavations, $25,000 for other public works, $40,000 for industrial and $150,000 for commercial buildings.

MONEY VALUE OF CONTRACTS LET—ENTIRE U. S.

Week Ending	Public Work	Private Work	Total Contracts
May 14, 1925	$21,786,000	$24,744,000	$46,530,000
May 7, 1925	22,833,000	26,324,000	49,157,000
May 15, 1924	21,484,000	25,500,000	46,984,000
Heaviest Week			
1924, May 8	26,370,000	38,829,000	65,199,000
1925, Apr. 2	43,603,000	27,633,000	71,236,000
Jan. 1 to Date			
1925	358,152,000	482,219,000	840,371,000
1924	348,371,000	448,442,000	796,813,000

E. N.-R. Statistics of Engineering Construction

Engineering News-Record's statistics are compiled from the original reports sent in by its own correspondents, who are instructed to verify every detail. The following minimum costs are observed: Water-works and Excavation, Drainage and Irrigation, $15,000; other public works, $25,000; Industrial Buildings, $40,000; Commercial Buildings, $150,000. The closeness of coverage is indicated by the evenness in both number and value of the projects reported. For example, contemplated work in the first four months of 1925 amounted to $2,006,640,000 compared with $1,949,781,000 in the same period last year. Values of awards in these two periods were $724,014,000 and $639,719,000 respectively. Numbers of projects reported in Construction News in the last six years follow:

	Proposed	Bids Desired	Bids Received	Contracts	Total
1919	13,861	4,789	1,521	5,472	25,643
1920	11,709	6,028	1,652	7,597	26,986
1921	11,699	6,831	1,732	7,047	27,309
1922	10,792	6,906	1,855	8,140	27,693
1923	14,703	7,136	2,278	8,906	33,023
1924	13,705	6,614	2,291	9,343	31,953

What Will 1925 Construction Be?
——An Analysis of Proposed Work

New E. N.-R. Statistics Give Value of Work Contemplated as Well as of Actual Contracts—New England and West Promise Activity

Of 2,704 projects worth $724,000,000, published in Construction News in first four months, 1,030 have been reported awarded for $296,979,000.

The amount of proposed work coming along but not yet ready for estimate is indicative of the volume of future contracts. *Engineering News-Record* has developed statistics of work contemplated which are similar in character to the figures covering actual lettings. The total value of contracts in the United States reported in Construction News in 1924 was $2,002,533,000. Proposed work that year amounted to $5,361,537,000, which is 2.7 times the awards. Much of the proposed work that did not reach the contract stage in 1924 will of course get there eventually.

Proposed work in the first four months of 1925 is 2.8 times the value of contracts awarded. According to these figures, construction contemplated throughout the United States is 2 per cent more than that of a year ago, while awards are 13 per cent above. Of this $2,006,000,000 worth of proposed construction, $342,503,000 worth has been placed under contract. All contracts in this period totaled $724,000,000. Table I gives total proposed work in the first four months and the amount of it that Construction News reported awarded during the same period.

In April $123,285,000 worth of this work was awarded.

An analysis has been made of each class of project in each of six regions. The figures in Table II are the percentage difference of total money value of projects reported during the first four months of 1925 from those of the corresponding period in 1924. Studying the table horizontally gives a quick picture of general conditions in any section of the country. Viewing each column separately will give a country-wide picture of each class of proposed work.

The table shows the construction outlook to be most promising in New England, excellent in the states immediately west of the Mississippi, and quite satisfactory in the West. The sections of the country where the various classes of work may be expected to be active may be grouped as follows:

Water-Works—West of Mississippi; South; Far West.
Sewers—New England; West
Bridges—New England; South
Roads—New England; Far West
Buildings—New England; South; Middle West and West of Mississippi

$2,288,981,000 IS THE VALUE OF PROPOSED CONSTRUCTION REPORTED BY E. N.-R. IN FIRST FOUR MONTHS OF 1925, FOR U. S. AND CANADA

Table I—Projects in First Four Months of 1925

	Proposed	Awarded	Per Cent Awarded
Water-works	$95,278,000	$19,448,000	20
Sewers	75,734,000	12,482,000	16
Bridges	56,144,000	9,919,000	18
Streets and roads	305,252,000	86,050,000	28
Excavation, drainage and irrigation	89,119,000	1,561,000	2
Industrial buildings	113,616,000	14,990,000	13
Commercial Buildings	1,008,828,000	142,955,000	14
Federal Government	7,360,000	9,971,000	14
Unclassified	255,309,000	45,127,000	17
	$2,006,640,000	$342,503,000	17

The general situation as regards both proposed work and contracts actually awarded is shown by the following per cent changes as compared with 1924:

	Proposed	Contracts
New England	+238	+50
Middle Atlantic	— 26	+13
Southern	— 1	—12
Middle West	+ 1	+10
West of Mississippi	+ 21	+37
Far West	— 12	+ 7
United States	+ 3	+13

Table II—Construction Outlook as Judged From Per Cent Gain or Loss in Money Value of Proposed Projects, Jan. 1 to May 1, Compared With Year Ago

	Water-Works	Sewers	Bridges	Excav. Irrig.	Sts. and Roads	Indus. Bldgs.	Com. Bldgs.	Fed. Gov't.	Unclass.	All	Per Cent of Total Constr.
New England	+29	+458	+582	+702	+940	+131	+234	+83	+500	+238	10
Middle Atlantic	—2	—66	—61	—53	—61	—80	—0.2	+150	—6	—26	15
South	+111	—91	+26	—70	—38	—43	+60	+34	+47	—1	14
Mid West	—79	—10	—64	+112	—6	—28	+31	—85	+62	+1	16
West of Mississippi	+184	+124	—0.1	+88	—21	—12	+29	+1380	+30	+21	23
Far West	+81	+143	—39	—6	+8	—51	—41	+384	+24	—12	22
United States	+17	+32	—38	+7	—24	—40	+18	+125	+31	+3	100

Materials Movements Show Seasonal Activity

(*Continued from p.* 834)

Cement—Reserve mill stocks are close to the heaviest ever recorded. Reports of the Geological Survey show the cement movement to be on the up grade, so far as production and shipments are concerned. Although production is heavier than at any time since October, 1924, demand has also increased to a commensurate degree. This leaves reserve mill stocks for the nation, about 587,000 bbl. under the heaviest ever recorded, that of Mar. 31, 1925. The following table shows the situation for the first five months of this year compared with the corresponding period last year:

	1925 Barrels	1924 Barrels
Production	41,952,000	39,472,000
Shipments	35,850,000	32,909,000
Stocks on hand May 1	19,882,000	17,159,000

Weekly Construction Market

MUCH of the dullness complained of in the current market is evidently due more to high expectations than to actual business depression.

Car loadings are the heaviest recorded so far this year; much of this is merchandise and less-than-car lot freight. Bank debits continue in large volume. Projected construction is 3 per cent ahead of this time last year.

These three factors show that an unusually large quantity of merchandise is moving and that a commensurate amount of money is changing hands, also that construction, one of the key industries, is more than holding its own.

Cost of labor stays high. Lumber and brick are both much firmer than a week ago. Steel, linseed oil, plumbing fixtures and several other factors are still weak as to price.

The slope in cost of construction has been so gradual since March 1 that many builders are coming back into the market without waiting for a "bottom" to be reached. Reports to *Engineering News-Record* during the week, show a revival of building interest in such centers as New York, Los Angeles, Tacoma, Seattle and Columbus, Ohio.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb.	$3.34	$3.90	$4.15	$3.10	$3.35	$3.07½	$3.30	$3.35	$4.25
Structural rivets, 100 lb.	4.50	4.45	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.40	3.38	3.00	3.25	3.87½	3.35	3.25	2.30
Steel pipe, black, 3½ to 6 in. lap, discount	48%	53.2%	43%	—57%	54.25%	36%	40.6@52.1%	50%	59.49
Cast-iron pipe, 6 in. and over, ton	52.60@53.60	+56.00	56.00	46.70@48.20	53.00	62.00	55.00	55.00	60.00
Concreting Material									
Cement without bags, bbl.	2.50@2.60	2.30	2.05	2.20	2.42	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	2.75	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.75	1.75	2.50	2.15	3.00	1.90
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	+60.00	35.00	56.00	29.00@39.00	39.75	34.75	27.00	23.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl.	2.50@2.75	1.45	1.85	1.21	1.35	2.70	1.60	2.80	9.50
Common brick, delivered, 1,000.	17.00	10.50	12.10	12.00	13.50@13.60	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block.	Not used	.0808	+ .10	.06	.07	.085	.....	.10	.12
Hollow partition tile 4x12x12, per block.	+.1162	.0808	+ .10	.06	.....	.085	.108	.10	.10
Linseed oil, raw, 5 bbl. lots, gal.	+1.09	—1.14	1.30	—1.23	—1.15	—1.25	—1.15	1.12	+1.25
Common Labor									
Common labor, union, hour	.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.75	.50@.55	.35@.50	.50	.50	+.25@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Labor—Concrete laborers' rate, 93⅜c.; building laborers, 75c.; excavating laborers, 50c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.60 for Sheboygan. Common labor not organized.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of April 2, the next on May 7.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 100.03). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.

Business Briefs

Call money quoted at 3½ per cent, Monday, May 11.

Time loans for both short and long periods, 3¾@4 per cent.

Foreign exchange (Demand):

	Par	This Week	Last Week	Year Ago
Sterling	$4.8665	$4.84⅛	$4.84¼	$4.36¼
Franc	.193	.0521½	.0523½	.0560½
Lira	.193	.0410½	.0410½	.0442½
Mark	.238	.2381	.2381	.....
Florin	.402	.4017	.4016	.3729
Peseta	.193	.1445	.1461½	.1380
Krona	.268	.2674	.2676	.2650

Foreign Projects of Interest to Americans

Following are taken from *Commerce Reports*, Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce.

Bridge over Yaguaron River between Uruguay and Brazil. New call for bids; copy of same available to accredited American concerns at Bureau's district office, 734 Customhouse, New York City.

Wharves proposed by Harbor Board, Vancouver, B. C. Appropriation of $1,350,000 requested from Dominion Government. (Assistant Trade Commissioner, W. J. Donnelly, Ottawa, Canada.)

Railway to be constructed in Australia. Specifications now under way for line from Kyogle, New South Wales, to South Brisbane. Work will involve expenditure of £3,500,000.

Highroads for Newfoundland, provided for in bill now being passed. Will involve 220-mi. of road for about $1,110,000. Reference No. 168,324.